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DISTRIBUTION OF ANGLE OF OBLIQUITY OF LASER-GUIDED PROJECTILES WITH RESPECT TO THE TARGET AT IMPACT

GEORGE J. SCHLENKER
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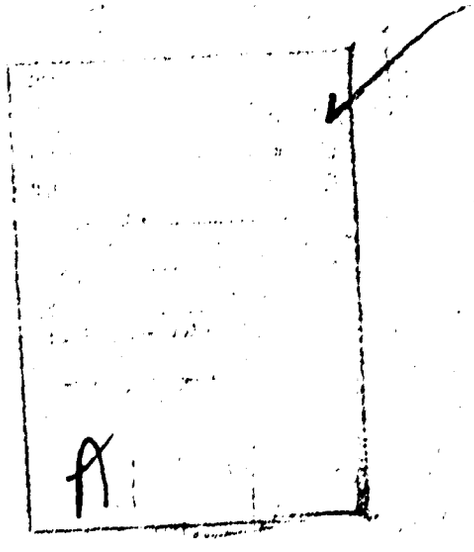

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

Impact obliquity is defined as the angle between the longitudinal axis of the projectile and the surface normal (or perpendicular) at the instant when the projectile first contacts a surface element of the target.

In this note the discussion is principally concerned with impact obliquity versus a T54/55 tank target and the factors which affect its statistical distribution.

The primary purpose of this study is to compute an overall or global probability distribution of impact obliquity for laser guided projectiles in a

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typical scenario. Secondarily one wishes to determine the sensitivity of several parameters on the distribution of obliquities. Important by-products of the study methodology are estimates of guidance accuracy, flight speed at impact, and angle of attack at impact. The computer program for processing impact data is included.

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BACKGROUND

Impact obliquity is defined as the angle between the longitudinal axis of the projectile and the surface normal (or perpendicular) at the instant when the projectile first contacts a surface element of the target. One should not confuse the impact obliquity with the angle between the velocity vector of the projectile and surface normal at impact. To be specific, call the latter "velocity obliquity." If the projectile has a negligibly small angle of attack, i.e., angle between the velocity vector and the form axis, the velocity obliquity approximates the impact obliquity of (the longitudinal axis of) the projectile. For ballistic projectiles this approximation is often a reasonably good one; however, for guided projectiles, angles of attack up to 20 degrees are not uncommon. Consequently, the impact obliquity may be quite different from the velocity obliquity. This note will be principally concerned with impact obliquity and the factors which affect its statistical distribution.

There has been a continuing interest by the Project Manager of the Cannon Artillery Weapons Systems (PM-CAWS) in this subject since the advent of the advanced development program (AD) for the Cannon-Launched Guided Projectile (CLGP). As this program moved into engineering development (ED), there has been a heightened interest in the subject of impact obliquity for several reasons. The fuze function may be degraded by large impact obliquities -- say, 80 degrees or more. Even with the surface-wave sensors, with which CLGP is equipped, the initiation-of-warhead event may be delayed too long following impact for optimal warhead function. Reliability and effectiveness of fuze operation as a function of impact obliquity is currently under study. It is anticipated that the results of the present study will contribute to a definition of the severity of the fuze-function problem.

Currently there is a special interest in the implications of spaced- or array armor on the reduction in lethality of antiarmor missiles. Clearly, the degradation in lethality of existing shaped-charge warheads against improved armor will be a function of the impact obliquities typically encountered. Thus, the configuration of the warhead (and its design adequacy) will interact with other system characteristics which influence impact obliquity. For all of the above reasons impact obliquity of guided projectiles is considered a germinal subject.

PURPOSES OF THE STUDY

The primary purpose of this study is to compute an overall or global probability distribution of impact obliquity for CLGP in a typical scenario. The secondary purpose is to determine the sensitivity of several parameters on the distribution of obliquities. Important by-products of the study methodology are estimates of guidance accuracy, flight speed at impact, and angle of attack at impact.

PARAMETERS OF INTEREST

Having had some experience with guided-projectile flight simulations from previous studies, we had developed expectations regarding the parameters

which might affect the impact obliquity. Obviously, the geometry of the target itself and the position thereon at which the laser is aimed would be expected to influence the distribution of obliquity. To investigate this parameter in a rigorous manner would require computer-based models of a substantial number of combat vehicles. Unfortunately, the effort to develop models of several vehicles was beyond the scope of the immediate study. Therefore, the effect of target vehicle geometry is inadequately studied here. We had to be content with three different models of the same vehicle--the T55 tank. The three models represent different degrees of facetization or fidelity to the objective vehicle and, consequently, slightly different geometries. By comparing the results of identical terminal plane impacts using each of these models, one may draw some qualitative inferences concerning the effect of target geometry. In this context the terminal plane is simply a plane normal to the velocity vector and passing through a fixed point on the target.

Another parameter of interest in this study is the deflection of the target with respect to the plane of the ballistic trajectory, i.e., with respect to the line of fire. Deflection of the target is expected operationally due to errors in locating the target, in pointing the gun, and in the ballistics of the unguided phase of flight. After acquisition of the target, the projectile will sense its heading error and will attempt to null this error and fly a proportionally navigated (PN) trajectory toward the target. In doing so, the relative aspect of the target will change along with the velocity of the projectile (speed and angle). Because of these effects, target deflection is an influential parameter for impact obliquity.

The range from designator to target is an important parameter, affecting guidance accuracy. As explained in the references [1]* and [2]*, laser spot motion is generally the single, most significant error source for laser-guided missiles and projectiles. Longer designation ranges produce larger spot excursions at the target and, consequently, larger guidance errors. In effect, the larger dispersion of impacts means a greater number of facets of the target which are struck and, with a concomitant increased dispersion in projectile angles of attack, implies a greater dispersion in impact obliquity.

For a given designation range and azimuthal position of the laser relative to the target, the laser signature, i.e., apparent spot motion and intensity seen by the projectile, is affected by the azimuth of the target with respect to the line of fire. A set of five discrete target signatures are used in the study to investigate the effect of this parameter.

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*Square-bracketed numbers refer to cited literature.

[1] Memorandum for Record, AMSAR-SAM, 23 July 1975, subject: Army-Navy Guided Projectile Effectiveness Study.

[2] Memorandum for Record, AMSAR-SAM, 17 December 1974, subject: Army-Navy Guided Projectile Commonality Study.

The five standard signatures, developed for the CLGP Test Integration Working Group, are labeled TIWG 1 thru 5.

The set of parameters which characterize the ballistics of the projectile in guided flight may also be expected to affect impact obliquity. These characteristics include such things as: presence (or absence) of gravity bias, use of synthetic damping in the autopilot, navigation ratio, aerodynamic characteristics, etc. Two quite different approaches to guided projectile design are used in this study to examine the effect of projectile system characteristics. The ED version of the Army's CLGP is one approach; the Navy's 5-inch, sleeved-guided projectile is the other. The same systems were examined in an operational context to assess their relative cost-effectiveness (Ref [1]). In the present study no conclusions are drawn about the relative terminal effects of these systems. Clearly, both systems would have to contend with their dispersions in impact obliquity in terms of fuze reliability and warhead function. It is the intention of this study to investigate differences in the distributions of impact obliquity. In summary, this study investigated four parameters, each at several discrete levels -- designation range, laser (TIWG) signature, target offset, and system type.

STUDY METHODOLOGY

The procedure followed in computing the impact obliquity is outlined, briefly, as follows:

a. Generate target signature with ERIM Target Reflectivity Model.

b. Using laser signature in appropriate secnario with other noise sources, employ 5 DOF flight simulator (ZOT.14) to simulate a set of guided flight trajectories.

c. Save impact-plane statistics for use in multi-faceted target models.

d. For each impact, perform linear transformation on the target facets to project the target into the impact plane.

e. Use dot-(inner) product method to identify the facet struck.

f. Employ cross-product method to determine direction of outward normal.

g. Use dot product of surface-normal vector and body-axis vector to determine impact obliquity.

Impact obliquities for each scenario so computed are saved for statistical post-processing. Additional information concerning the various submodels

[1] Op. Cit.

is provided below. A computer program for postprocessing impact data is listed in Appendix B.

A collection of obliquities is obtained for each set of values of the parameters of interest. The set of parameters represents a particular treatment combination in the design of computer experiments. The collection of obliquities represents the Monte-Carlo sample for all shots impacting the target. The post-processor rank orders the obliquities in each experimental set and computes an estimate of the median rank associated with each ordered obliquity value. These statistics are linearly interpolated to calculate percentile estimates — from the 5th thru the 95th at increments of 5%. The post-processor saves the array of percentile estimates for subsequent manipulation.

Notationally, let $P_{ijk\ell}(x)$, $x = (5,10,\ldots,95)$, represent the estimate of the x th percentile associated with the experimental treatment given by the subscripts, where the subscript i is associated with the level of designation range, j with the level of the laser-signature parameter, k with the level of target deflection, and ℓ with the projectile system. Weights are associated with each of the four parameters of interest--designation range, a_i; laser signature, b_j; and target deflection, c_k. The system suoscript ℓ is added for notational convenience. No attempt was made to weight the systems, and each of the two systems was treated separately. The above weights are normalized and can be considered marginal probability density functions for the purpose of developing contingency tables.

Thus,

$$\Sigma_i a_i = \Sigma_j b_j = \Sigma_k c_k = 1.$$

The single-factor effect of a particular parameter on the obliquity distribution, P(x), is obtained by weighting the percentile arrays and summing over all parameters except the single parameter (factor) of interest. For example, if the projectile system effect is of interest, an average distribution is computed as follows:

$$\overline{P}_{\ldots\ell}(x) = \Sigma_i a_i \Sigma_j b_j \Sigma_k c_k P_{ijk\ell}(x) \quad .$$

In the methodology sketched above, reference was made to the ERIM Target Reflectivity Model. This is a multi-program model of a combat vehicle developed under contract with the Rodman Laboratories by the Envirionmental Research Institute of Michigan[3]. Its purpose is to describe the geometry and surface features of the vehicle sufficiently well so that the distribution of reflected laser energy is determined, given the characteristics of the incident laser beam. The incident laser is treated as a pulsed beam of fixed beam divergence, power, designation range, and having second-

[3]Beard, J., Rice, D., and Ladd, D. Target Reflection Illumination Model With Second Order (TRIMS) (U); (CONF), ERIM Report No. 192200-2-F, August 1975.

order spot motion dynamics with specified spectral density. Output is the pulse-by-pulse position and intensity of the apparent laser spot viewed by the projectile seeker. This stochastic process can be reduced to a summary statistical model suitable for input to any terminal guidance simulation. The target reflectivity model is maintained and operated by the physics team in the Rodman Laboratories. The laser signature inputs used in this study were prepared by them. Additional analyses, to be described later, were also performed by the team at Rodman in cooperation with the authors.

The ERIM Laser Target Reflectivity Model, referred to above, contains a model of the target in which the vehicle and its surroundings are described in terms of contiguous, triangular facets. The location of each facet is described by the coordinates of its vertices and the outside surface of the facet is described by a vector normal to the surface passing through its centroid and having an inside-out direction. This direction is such that the right-hand thumb would have if the fingers of the right hand traversed the vertices in a counter-clockwise direction on the outside surface of the facet. The number of facets used to describe a particular vehicle is somewhat arbitrary. If a large number of facets is used, the approximation to the surface geometry of the actual vehicle can be excellent; however, the computational time to generate a laser signature may become prohibitively large. A model with fewer facets may be quite suitable for certain purposes while achieving a desirable degree of computational efficiency. To meet these conflicting requirements of computational efficiency and fidelity to target geometry, the Rodman physics team has devised two T55 target models having different degrees of facetization. These models are referred to as the HIFAC and LOFAC target models. The HIFAC model has the higher degree of facetization. Computer-generated displays of the geometry of these models are shown in Figures 1 and 2. For comparative purposes, the geometry of the SA target model is shown in Figure 3. The character of the surface of the target vehicle necessary to compute first-and second-order reflections is also described within the ERIM model. For the purpose of the present study, calculation of second-order reflections was omitted and a diffusely-reflecting surface was assumed.

The spot jitter characteristics used in generating the laser signatures were based upon the measurements taken during the CLGP OT 1 Tracking Tests. These tests indicated that the Ground Laser Locator Designator (GLLD) would have a horizontal component of the tracking error of about 100 microradians standard deviation and a vertical component of approximately 50 microradians standard deviation in daylight tests at ranges from 1.5 to 3 km. In addition to a jitter component due to atmospheric scintillation of about 40 microradians SD, which was present during day tests and virtually absent at night, a jitter component having the typical second-order dynamics of the man-operated GLLD was in evidence. Consequently, the spot motion dynamics used as input to all the flight simulations had second-order Butterworth dynamics with a 0.9 hz corner frequency.

DESIGN OF COMPUTER EXPERIMENTS

The experimental variables described above were treated parametrically

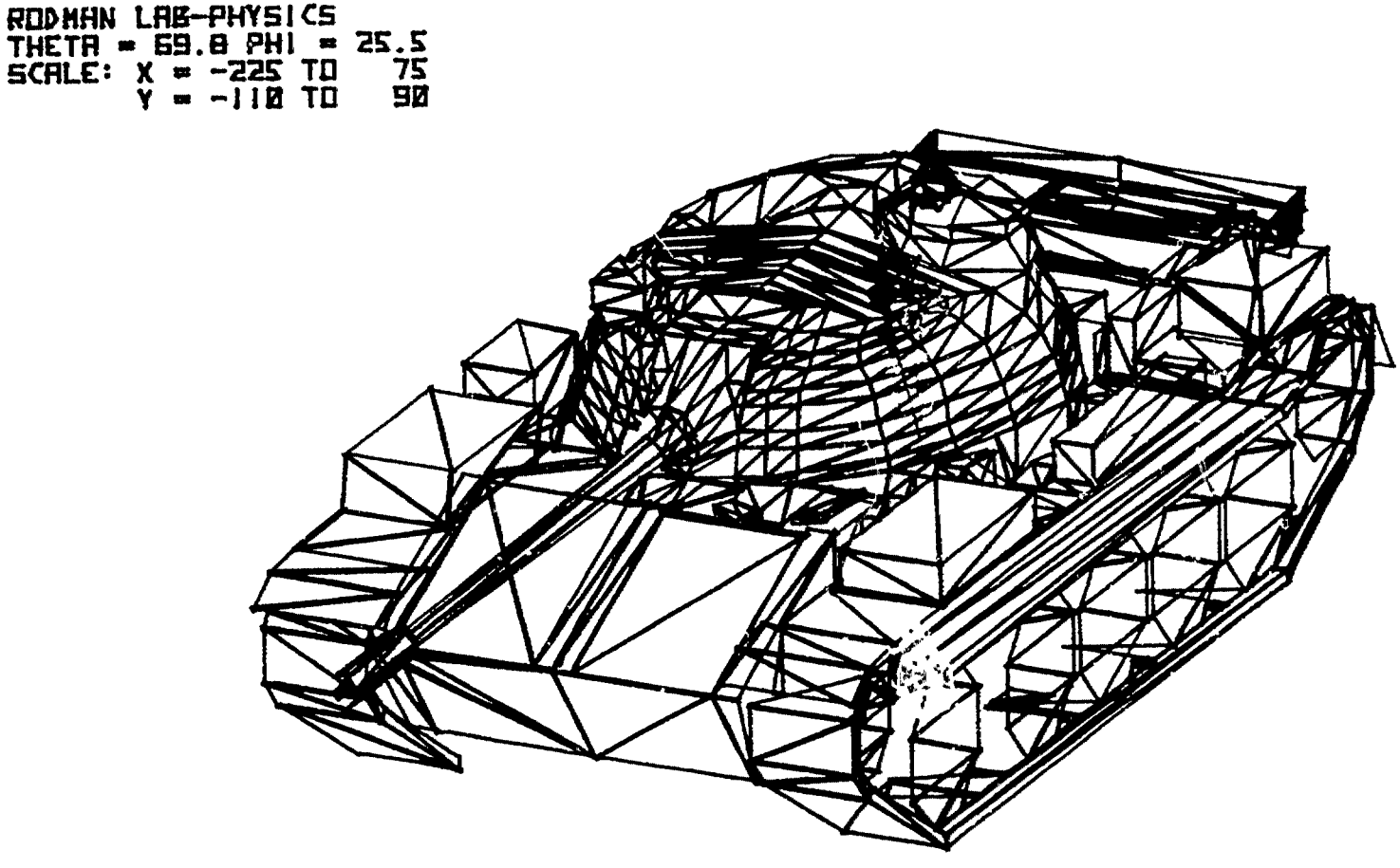
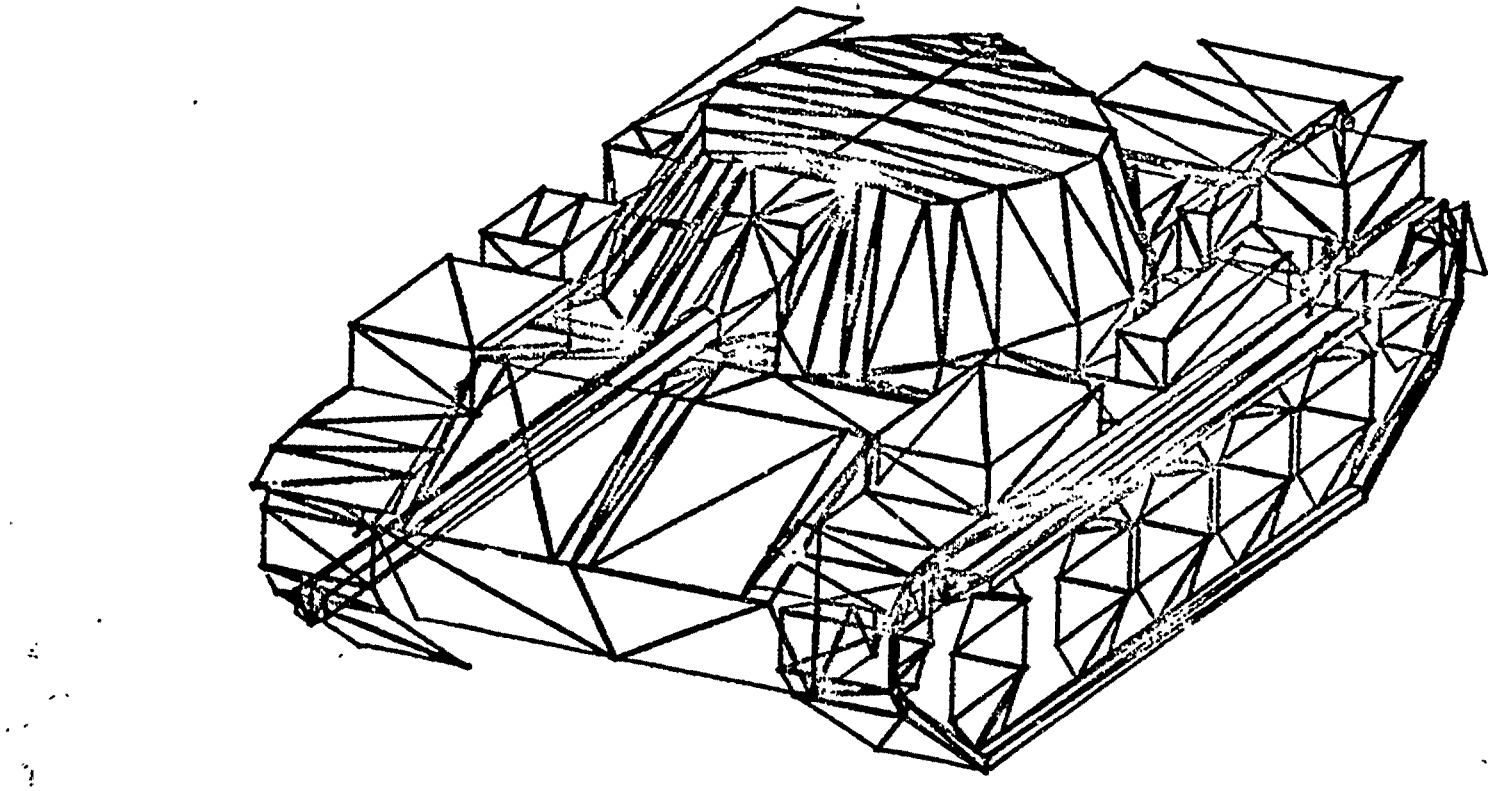


Figure 1. Target Geometry Used in the HIFAC Model of the T55 Tank



TYPICAL LOFAC VIEW FOR IMPACT OBLIQUITY RUNS

Figure 2. Target Geometry Used in the LOFAC Model of the T55 Tank

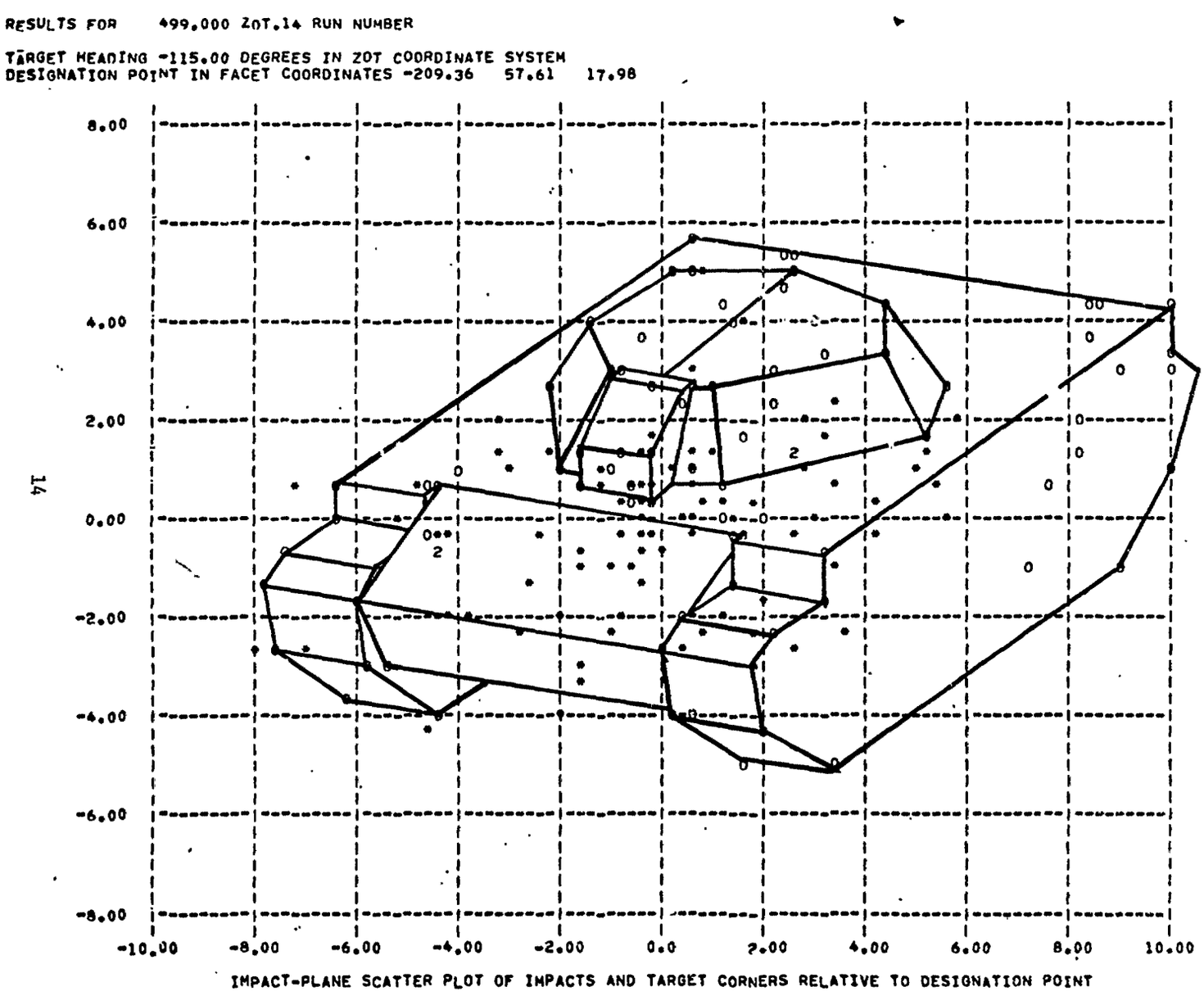


Figure 3. Target Geometry Used in the SA Target Model of the T55 Tank

in this study. The target vehicle was assumed to be traveling at a constant speed of 5 m/s along a straight-line path, making an azimuthal angle ϕ relative to the line of fire. The values of ϕ used here are: 5, 15, 25, 35, and 45 degrees. These angles correspond, respectively, to TIWG signature numbers 1 thru 5. The laser designator was assumed to be facing the front of the vehicle at a designation range R. The values of R used in the study are: 1, 2, 3, and 4 km. Consistent with OT 1 tracking data, the spot motion amplitudes were assumed proportional to designation range for each of the target vehicle aspects (signatures). The initial deflection of the target, i.e., at the time the flight simulation starts, relative to the line of fire is varied parametrically at two levels -- 0 and 300 meters. The gun-to-target range was not treated as a parameter of interest in this study because previous studies[1,2] had established that guidance accuracy is insensitive to this parameter over a wide range of values. A nominal value of 10 km was used for the gun-to-target range. Additionally, cloud height was fixed at 2500 ft and meteorological visibility range was fixed at the nominal 10 km. Target reflectivity was also a constant 10%.

For each combination of the parameters of interest--i.e., treatment in the experimental sense--a set of 85 replications of the terminal guidance simulation, ZOT.14, were made to form estimates of the statistics--guidance errors, terminal velocity, and impact obliquity. This Monte-Carlo sample size was chosen to permit one to make discriminations between systems whose guidance CEPs differ by as little as 10%. In fact, with a sample of 85 the probable error in the estimate of the linear standard deviation of either the yaw-wise or pitch-wise component of the miss distance (relative to center of aim) is less than 6%--about 1.7 inches for σ = 2.5 ft. Additionally, the variance-reducing scheme of blocking was employed for all sources of stochastic variation. To sharpen the ability to make discriminations between different levels of any parameter, the variability due to different sequences of random numbers in a replication for each type of random variable was eliminated; i.e., corresponding replications for different parameter levels used the identical set of streams of random numbers (although the number of values in the stream used up at impact might differ). The noise sources treated were spot motion or jitter (previously mentioned), pitch-yaw coupling, projectile acquisition range, and initial heading error. The target position was varied over the replications in constant increments from a position 100 meters uprange of the ballistic impact point (bip) to a position 400 meters downrange of the bip.

A full-factorial set of computer experiments would involve 5 signatures x 4 designation ranges x 2 deflections x 2 systems or 80 experiments. The set of experiments actually performed was a partical-factorial set of the 50 most probable contingencies. The matrix of experiments is shown in Table 1. The entries in the table are the run numbers used to identify each experiment. The reader may wish to refer to this table later.

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[1] Op. Cit.

[2] Op. Cit.

TABLE 1. MATRIX OF COMPUTER EXPERIMENTS* FOR THE COMPARATIVE STUDY OF IMPACT OBLIQUITY

Gun-Target Range 10 Km

Initial Gun-Target Deflection (m)		MMA ED (Oct 75)					Navy AD (Specified)				
	Designation	TIWG Signature					TIWG Signature				
	Range (km)	1	2	3	4	5	1	2	3	4	5
0	1			497	505				522	530	
	2	491	494	498	506	513	516	519	523	531	538
	3	492	495	499	507	514	517	520	524	532	539
	4			500	508				525	533	
300	1			501	509				526	534	
	2			502	510				527	535	
	3	493	496	503	511	515	518	521	528	536	540
	4			504	512				529	537	

*Each experiment consists of 85 replications with the prescribed stochastic signature, the target being moved uniformly over a 500 meter range.

The contingencies examined represent about 89% of event space.

WEIGHTING OF EXPERIMENTAL RESULTS

As indicated above in the section on methodology, the estimated distributions of impact obliquity are weighted in accord with weight functions each of which represents the marginal probability associated with a given parameter. For example, the weight function associated with the TIWG laser signature is shown in Table 2. Similarly, the weight function associated with designation range is shown in Table 3. These functions were derived from computational experience gained from the CLGP Operational Simulation (OSM) during and subsequent to the CLGP COEA. The histograms of seeker azimuth and designation range compiled by OSM were further aggregated to form the weights displayed in these tables.

RESULTS OF COMPUTER EXPERIMENTS

Although the primary purpose of this study is to examine the subject of impact obliquity, a variety of derivative results may also be of interest. The following paragraphs address these topics: guidance accuracy, impact speed, angle of attack of the projectile at impact, and impact obliquity. Results concerning these subjects are intended to complement those of References [1] and [2].

Guidance Accuracy

The statistics pertaining to guidance accuracy are summarized in Tables 4A and B for the Army ED CLGP and in Tables 4C and D for the Navy 5-in/155mm sleeved projectile. A cursory examination of these tables reveals that the Army CLGP is more accurate than the Navy guided projectile at the same designation range, target deflection, and for the same signature. As elaborated in the Memoranda for Record[1,2],the reasons for this difference reflect fundamental differences in projectile design philosophy and implementation. At short designation ranges, the accuracy differences between these systems are manifestly inconsequential. However, at ranges in excess of 3 km, or for large-amplitude spot jitter, the more sophisticated Army system produces higher hit probabilities.

As observed in other studies[1,2], guidance accuracy is a strong function of designation range. Tables 4A through 4D show that guidance error also depends upon the laser signature--which in turn depends upon the target aspect for the designator and for the projectile seeker. Generally, accuracy is degraded as the azimuth of the projectile is permitted to increase, when the designator is fixed at zero azimuth. For example, Table 4A indicates an increase in the CEP from 1.76 to 1.90 ft at a designation range of 2 km. Because target presented area also increases

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[1] Op. Cit.

[2] Op. Cit.

TABLE 2. WEIGHT FUNCTION FOR
LASER (TIWG) SIGNATURE USED IN
COMPARATIVE STUDY OF IMPACT OBLIQUITY

TIWG Designation No.	Designator* Az, El (deg)	Seeker Azimuthal Aspect (deg)	Weight (Fraction)	Cumulative Weight
1	0, 0	5	.005	.005
2		15	.060	.065
3		25	.335	.400
4		35	.420	.820
5		45	.180	1.000

*Designator aim point (inches) in Rodman T55 vehicle coordinate system -- (192.5, 15.5, 57)

TABLE 3. WEIGHT FUNCTION
FOR DESIGNATION RANGE

Designation Range (km)	Weight Fraction	Cumulative Weight
1	0.05	0.05
2	0.20	0.25
3	0.45	0.70
4	0.30	1.00

TABLE 4A. GUIDANCE ACCURACY STATISTICS AS FUNCTIONS OF TARGET ASPECT AND DESIGNATION RANGE

System: MMA ED CLGP (Oct 75)
Target Deflection 0 m

Accuracy Statistic*	Desig. Rng. (km)	Target Azimuth (deg)				
		5	15	25	35	45
PH1	1			1.00	1.00	
PH2				1.00	1.00	
CEP(f)				0.92	0.89	
SD yaw(f)				1.02	1.13	
SD pitch(f)				0.58	0.56	
PH1	2	0.98	0.96	0.94	0.91	0.86
PH2		1.00	1.00	1.00	1.00	0.98
CEP(f)		1.76	1.83	1.78	1.81	1.90
SD yaw(f)		1.54	1.78	2.00	2.22	2.56
SD pitch(f)		1.18	1.21	1.15	1.12	1.08
PH1	3	0.87	0.81	0.77	0.73	0.67
PH2		0.98	0.98	0.95	0.95	0.93
CEP(f)		2.56	2.72	2.85	2.93	3.01
SD yaw(f)		2.27	2.63	2.96	3.27	3.72
SD pitch(f)		1.75	1.79	1.72	1.67	1.61
PH1	4			0.60	0.57	
PH2				0.88	0.87	
CEP(f)				3.74	3.90	
SD yaw(f)				3.86	4.23	
SD pitch(f)				2.26	2.19	

* PH1 = estimated probability of hitting a standard 7.5 x 7.5 ft NATO target.

PH2 = estimated probability of hitting a T55 tank, based upon a sample of 85 shots.

CEP = circular error probable or median miss distance relative to center of aim.

SD yaw = estimated standard deviation of horizontal component of miss distance in impact plane

SD pitch = estimated standard deviation of vertical component of miss distance in impact plane

Confidence intervals can be developed for the above standard deviations. Based on a sample size of 85 and using gaussian statistics, these probability statements concerning σ follow:

$$P\{0.889 \leq \sigma/\hat{\sigma} \leq 1.150\} = 0.90$$

and

$$P\{0.953 \leq \sigma/\hat{\sigma} \leq 1.058\} = 0.50$$

Thus, for a value of $\hat{\sigma}$ = 2.5 ft, the 90% confidence interval is approximately $\sigma \pm 4$ inches and the 50% (or probable) interval is $\sigma \pm 1.7$ inches.

TABLE 4B. GUIDANCE ACCURACY STATISTICS AS FUNCTIONS OF TARGET ASPECT AND DESIGNATION RANGE

System: MMA ED CLGP (Oct 75)
Target Deflection 300 m

Accuracy Statistic*	Desig. Rng. (km)	Target Azimuth (deg)				
		5	15	25	35	45
PH1	1			1.00	1.00	
PH2				1.00	1.00	
CEP (f)				0.87	0.88	
SD yaw (f)				0.77	0.87	
SD pitch (f)				0.59	0.58	
PH2	2			0.99	0.97	
PH2				1.00	1.00	
CEP (f)				1.65	1.70	
SD yaw (f)				1.52	1.71	
SD pitch (f)				1.15	1.13	
PH1	3	0.93	0.91	0.88	0.83	0.78
PH2		0.95	0.96	1.00	1.00	0.99
CEP (f)		2.21	2.32	2.40	2.58	2.54
SD yaw (f)		1.94	2.03	2.27	2.56	2.96
SD pitch (f)		1.58	1.70	1.71	1.69	1.64
PH1	4			0.71	0.67	
PH2				0.91	0.94	
CEP (f)				3.10	3.37	
SD yaw (f)				3.00	3.38	
SD pitch (f)				2.25	2.21	

* PH1 = estimated probability of hitting a standard 7.5 x 7.5 ft NATO target.

PH2 = estimated probability of hitting a T55 tank, based upon a sample of 85 shots.

CEP = circular error probable or median miss distance relative to center of aim.

SD yaw = estimated standard deviation of horizontal component of miss distance in impact plane

SD pitch = estimated standard deviation of vertical component of miss distance in impact plane

Confidence intervals can be developed for the above standard deviations. Based on a sample size of 85 and using gaussian statistics, these probability statements concerning σ follow:

$$P\{0.889 \leq \sigma/\hat{\sigma} \leq 1.150\} = 0.90$$

and

$$P\{0.953 \leq \sigma/\hat{\sigma} \leq 1.058\} = 0.50$$

Thus, for a value of $\hat{\sigma}$ = 2.5 ft, the 90% confidence interval is approximately $\sigma \pm 4$ inches and the 50% (or probable) interval is $\sigma \pm 1.7$ inches.

TABLE 4C. GUIDANCE ACCURACY STATISTICS AS FUNCTIONS OF TARGET ASPECT AND DESIGNATION RANGE

System: 5 in/155mm Navy Guided Projectile
with 2 sec rocket ignition delay
Target Deflection 0 m

Accuracy Statistics*	Desig. Rng. (km)	Target Azimuth (deg)				
		5	15	25	35	45
PH1	1			0.96	0.94	
PH2				1.00	1.00	
CEP (f)				1.42	1.26	
SD yaw (f)				1.84	1.96	
SD pitch (f)				0.74	0.74	
PH1	2	0.80	0.76	0.73	0.70	0.68
PH2		0.96	0.98	0.98	0.95	0.91
CEP (f)		2.65	2.78	3.09	3.44	2.99
SD yaw (f)		2.87	3.13	3.34	3.60	3.73
SD pitch (f)		1.48	1.45	1.38	1.38	1.37
PH1	3	0.64	0.59	0.58	0.56	0.55
PH2		0.84	0.88	0.87	0.86	0.87
CEP (f)		3.46	3.52	3.25	3.72	3.60
SD yaw (f)		3.75	3.95	4.12	4.35	4.51
SD pitch (f)		1.94	2.15	2.10	2.04	1.96
PH1	4			0.48	0.49	
PH2				0.84	0.85	
CEP (f)				4.07	3.96	
SD yaw (f)				4.29	4.50	
SD pitch (f)				2.73	2.56	

* PH1 = estimated probability of hitting a standard 7.5 x 7.5 ft NATO target.

PH2 = estimated probability of hitting a T55 tank, based upon a sample of 85 shots.

CEP = circular error probable or median miss distance relative to center of aim.

SD yaw = estimated standard deviation of horizontal component of miss distance in impact plane

SD pitch = estimated standard deviation of vertical component of miss distance in impact plane

Confidence intervals can be developed for the above standard deviations. Based on a sample size of 85 and using gaussian statistics, these probability statements concerning σ follow:

$$P\{0.889 \leq \sigma/\hat{\sigma} \leq 1.150\} = 0.90$$

and

$$P\{0.953 \leq \sigma/\hat{\sigma} \leq 1.058\} = 0.50$$

Thus, for a value of $\hat{\sigma} = 2.5$ ft, the 90% confidence interval is approximately $\sigma \pm 4$ inches and the 50% (or probable) interval is $\sigma \pm 1.7$ inches.

TABLE 4D. GUIDANCE ACCURACY STATISTICS AS FUNCTIONS OF TARGET ASPECT AND DESIGNATION RANGE

System: 5 in/155mm Navy Guided Projectile with 2 sec rocket ignition delay

Target Deflection 300 m

Accuracy Statistic*	Desig. Rng. (km)	Target Azimuth (deg) 5	15	25	35	45
PH1	1			0.99	0.98	
PH2				1.00	1.00	
CEP (f)				1.22	1.34	
SD yaw (f)				1.46	1.64	
SD pitch (f)				0.74	0.72	
PH1	2			0.78	0.74	
PH2				0.98	0.98	
CEP (f)				2.56	2.64	
SD yaw (f)				3.03	3.30	
SD pitch (f)				1.45	1.45	
PH1	3	0.69	0.63	0.60	0.57	0.54
PH2		0.80	0.85	0.86	0.86	0.81
CEP (f)		3.11	3.30	3.32	3.77	3.86
SD yaw (f)		3.25	3.70	3.98	4.25	4.59
SD pitch (f)		2.06	2.10	2.08	2.07	2.06
PH1	4			0.46	0.45	
PH2				0.74	0.81	
CEP (f)				4.27	4.24	
SD yaw (f)				4.79	4.90	
SD pitch (f)				2.59	2.58	

* PH1 = estimated probability of hitting a standard 7.5 x 7.5 ft NATO target.

PH2 = estimated probability of hitting a T55 tank, based upon a sample of 85 shots.

CEP = circular error probable or median miss distance relative to center of aim.

SD yaw = estimated standard deviation of horizontal component of miss distance in impact plane

SD pitch = estimated standard deviation of vertical component of miss distance in impact plane

Confidence intervals can be developed for the above standard deviations. Based on a sample size of 85 and using gaussian statistics, these probability statements concerning σ follow:

$$P\{0.889 \leq \sigma/\hat{\sigma} \leq 1.150\} = 0.90$$

and

$$P\{0.953 \leq \sigma/\hat{\sigma} \leq 1.058\} = 0.50$$

Thus, for a value of $\hat{\sigma}$ = 2.5 ft, the 90% confidence interval is approximately $\sigma \pm 4$ inches and the 50% (or probable) interval is $\sigma \pm 1.7$ inches.

with azimuth, the probability of hitting the target vehicle (PH2) does not decline appreciably with increasing azimuth.

The combined effects of initial deflection of the target, target motion, and target azimuth interact to produce a complicated picture of accuracy as a function of these parameters. In some instances the effect of initial deflection is to produce a more favorable target aspect at impact. In all cases treated here, initial deflection causes a maneuver which reduces the terminal airspeed relative to a projectile having zero deflection. The lower airspeed effectively reduces the terminal navigation ratio and, consequently, the sensitivity to spot motion.

In comparing the accuracy estimates for the same systems derived in [1] with those in this study, differences will be noticed. Although some system parameter values were changed for the present study, the primary reason for the differences lies in the different laser signatures used in the two studies. This is the case even though the laser jitter characteristics are the same in both studies. The accuracy values presented in Ref [1] are based upon a designation geometry in which the designator is at an azimuth of 45 deg to the front of the target vehicle and the projectile seeker is at an azimuth of zero and at an elevation of 25 degrees. The signature associated with this situation is called WC 1. Although the azimuthal positions of the designator and seeker are reversed relative to the above for the TIWG 3 signature used here, the pattern of spot motion as seen by the seeker is quite different in TIWG 3 and WC 1. For comparison the yaw- and pitch-wise spot motion standard deviations and the coefficient of correlation between these jitter components are shown below for both signatures.

Signature Number	Apparent yaw SD (ft)	Apparent pitch SD (ft)	Pitch-yaw correlation
WC 1	0.570	0.653	-0.10
TIWG 3	1.464	0.834	0.36

Primarily due to the difference in apparent spot motion, the CEP estimated for the Army ED CLGP at 3 km in [1] is 2.00 ft whereas at the same designation range the present estimate of CEP is 2.85 ft with zero initial deflection and 2.40 ft with 300 m initial deflection. This suffices to illustrate the importance of choosing a common scenario when comparing the accuracy of several systems.

Impact Speed

The mean and standard deviation of the speed at impact of the Army CLGP is shown in Table 5. Since only one firing zone, QE, and nominal gun-target range were examined in this study, the range of impact velocities

[1] Op. Cit.

TABLE 5. MEAN AND STANDARD DEVIATION OF IMPACT SPEED OF ED CLGP FOR EACH COMPUTER EXPERIMENT

Initial Gun-Target Deflection (m)	Designation Range (km)	TIWG SIGNATURE NUMBER				
		1	2	3	4	5
0	1			810.3 12.7	809.8 12.7	
	2	809.9* 12.5**	809.0 12.7	808.5 12.8	807.8 12.9	806.9 12.9
	3	807.6 12.6	806.8 12.7	806.0 12.8	805.2 12.9	804.1 13.1
	4			803.3 12.9	802.4 13.1	
300	1			782.8 5.5	784.0 5.8	
	2			781.5 5.5	782.6 6.1	
	3	776.9 4.6	778.5 5.2	779.7 5.8	780.6 6.4	781.0 6.9
	4			777.7 6.2	778.4 6.7	

* mean speed (fps)

** std. dev. of speed (fps)

is restricted relative to the operational range. Stochastic variations in impact conditions with zone and QE fixed depend upon the variable degree of maneuver required to reach the target. As seen in Table 5, the standard deviation in impact speed is generally less than 13 f/s for a mean speed of about 800 f/s. The launch velocity in this case is 1869 f/s produced by zone 7 of the XM201 prop. chg at a QE of 20 deg with a 145.4 lb projectile.

Angle of Attack

By convention, positive yaw is projectile nose to the left while facing in the direction of flight and positive pitch is nose up relative to the direction of flight. It can be seen from Table 6 that the dispersion in angle of attack varies significantly with designation range, slightly more than doubling in standard deviation between 1 km and 4 km. The mean yaw shows no consistent pattern and would be expected to vary with the initial heading error and the direction of target motion. The mean pitch angle is slightly positive at impact. For both systems, mean pitch at impact is about 2 deg. The pitch and yaw dispersions increase with designation range (or laser spot jitter). Differences between systems are not physically significant. The distribution function for the angle of attack is observed to be distinctly non-gaussian.

Impact Obliquity

The effects of the parameters of interest on the distribution of impact obliquity are shown in Tables 7A thru 7D. The median impact obliquity decreases as designation range increases; however, the dispersion of obliquities increases somewhat with designation range for the Army CLGP. Consequently, the upper tail of the probability density function of obliquity with respect to designation range is more positively skewed with increasing range. The effect of designation range on the parts of the target vehicle struck by the Army CLGP is shown in Figure 4. For the Navy 5-in/155mm sleeved round, the combined effects of greater dispersion of guidance error and larger negative mean center of impacts in pitch with respect to designation range produce more impacts on the front glacis. This has the effect of reducing the dispersion of impact obliquity with respect to designation range for this system. See Table 7A.

The effect of initial deflection on impact obliquity statistics is fairly subtile and has a significant second-order interaction with other parameters. For example, the median obliquity decreases somewhat with deflection for the Army system but increases by a comparable amount with respect to deflection for the Navy system (Table 7B). This difference in trend between systems is explained in part by the fact that the Navy sleeved-round uses a larger navigation ratio than the Army system does. As a consequence, the Navy round turns toward the target quicker than does the Army projectile and has a different aspect in the endgame.

As noted in Table 6C, no simple, monotonic relationship is apparent between mean impact obliquity and laser signature (or target aspect).

TABLE 6A. STATISTICS FOR IMPACT ANGLE OF ATTACK OF CLGP

System: MMA ED (Oct 75)
TIWG Signature: 3 (25 deg seeker azimuth)

Initial Gun-Target Deflection (m)	Designation Range (km)	Yaw Attack Mean (deg)	Yaw Attack SD (deg)	Pitch Attack Mean (deg)	Pitch Attack SD (deg)
0	1	-1.0	5.6	1.2	3.4
	2	-1.8	9.6	1.4	6.3
	3	-2.4	11.8	1.5	8.5
	4	-2.8	13.0	1.6	10.1
300	1	2.7	4.6	0.7	3.8
	2	2.6	8.1	0.6	6.9
	3	2.5	10.4	0.8	9.1
	4	2.4	11.9	1.0	10.6

TABLE 6 A. (cont.)
System: MMA ED (Oct 75)
TIWG Signature: 4 (35 deg seeker azimuth)

0	1	-1.0	6.1	1.3	3.4
	2	-1.7	10.1	1.4	6.2
	3	-2.2	12.2	1.5	8.4
	4	-2.5	13.3	1.6	10.0
300	1	2.6	5.1	0.7	3.7
	2	2.6	8.9	0.7	6.8
	3	2.5	11.1	0.9	9.1
	4	2.4	12.5	1.1	10.6

TABLE 6B. STATISTICS FOR IMPACT ANGLE OF ATTACK OF CLGP

System: 5 in/155mm Navy Guided Projectile
TIWG Signature: 3 (25 deg Seeker Azimuth)

Initial Gun-Target Deflection (m)	Designation Range (km)	Yaw Attack Mean (deg)	Yaw Attack SD (deg)	Pitch Attack Mean (deg)	Pitch Attack SD (deg)
0	1	1.9	8.7	3.4	5.2
	2	2.1	9.9	2.3	7.3
	3	1.9	11.0	2.1	8.9
	4	3.1	11.7	2.0	9.4
300	1	2.1	8.4	3.4	5.0
	2	2.2	9.4	1.3	7.6
	3	2.6	10.3	1.9	7.9
	4	1.5	11.8	2.7	8.5

TABLE 6B. (cont.)
System: 5 in/155mm Navy Guided Projectile
TIWG Signature: 4 (35 deg Seeker Azimuth)

0	1	2.5	8.6	4.0	4.9
	2	2.3	9.8	2.8	7.2
	3	2.1	11.1	2.4	8.8
	4	2.4	12.1	2.0	8.8
300	1	2.4	8.2	3.7	4.9
	2	2.6	9.3	1.9	7.3
	3	0.6	11.0	2.4	8.0
	4	0.5	12.0	2.4	8.6

TABLE 6C. COMPARISON OF IMPACT OBLIQUITY AND ANGLE OF ATTACK AS A FUNCTION OF TARGET ASPECT

System: Army ED CLGP
Initial Deflection 0
Designation Range 3 km

TIWG Signature Number/Az (deg)	Angle (deg)			
	Mean Obliq	SD Obliq	SD yaw attack	SD pitch attack
1/5	57.3	17.6	10.5	8.5
2/15	54.0	17.6	11.2	8.6
3/25	53.3	17.7	11.8	8.5
4/35	54.2	19.8	12.2	8.4
5/45	55.8	19.8	12.8	8.2

TABLE 7A. SINGLE-PARAMETER CONTRASTS FOR IMPACT OBLIQUITY: EFFECT OF DESIGNATION RANGE

System/Signature: Army ED CLGP with TIWG 3
Zero Initial Deflection

Obliquity Statistic (deg)	Designation Range (km)			
	1	2	3	4
median obliquity	61	58	56	56
interquartile range	18	19	23	24
25 th percentile	53	48	42	42
75 th percentile	71	67	65	66
90 th percentile	73	73	75	76

System/Signature: Army ED CLGP with TIWG 4
Zero Initial Deflection

Obliquity Statistic (deg)	Designation Range (km)			
	1	2	3	4
median obliquity	60	59	57	56
interquartile range	18	20	24	27
25 th percentile	52	50	45	41
75 th percentile	70	69	69	68
90 th percentile	74	73	76	77

System	Army		Navy	
Obliquity Statistic (deg)	Range (km)		Range (km)	
	2	3	2	3
median obliquity	59	57	57	55
interquartile range	20	24	31	26
90 th percentile	74	76	83	75

TABLE 7B. SINGLE-PARAMETER CONTRASTS FOR IMPACT OBLIQUITY: EFFECT OF DEFLECTION

Designation Range 3 km

System	Army		Navy	
Obliquity	Deflection (m)		Deflection (m)	
Statistic (deg)	0	300	0	300
median obliquity	57	53	55	58
interquartile range	24	26	26	24
90 th percentile	76	75	75	83

TABLE 7C. SINGLE-PARAMETER CONTRASTS FOR IMPACT OBLIQUITY: EFFECT OF SIGNATURE (TARGET ASPECT)

Weighted Averages

System	Army		Navy	
Obliquity	Azimuth (deg)		Azimuth (deg)	
Statistics (deg)	25	35	25	35
median obliquity	55	56	58	57
interquartile range	25	26	25	25
90 th percentile	75	76	79	81

TABLE 7D. SINGLE-PARAMETER CONTRASTS FOR IMPACT OBLIQUITY: EFFECT OF PROJECTILE SYSTEM

Weighted Averages

Obliquity	System	
Statistic (deg)	Army	Navy
median obliquity	56	58
interquartile range	25	25
90 th percentile	76	80

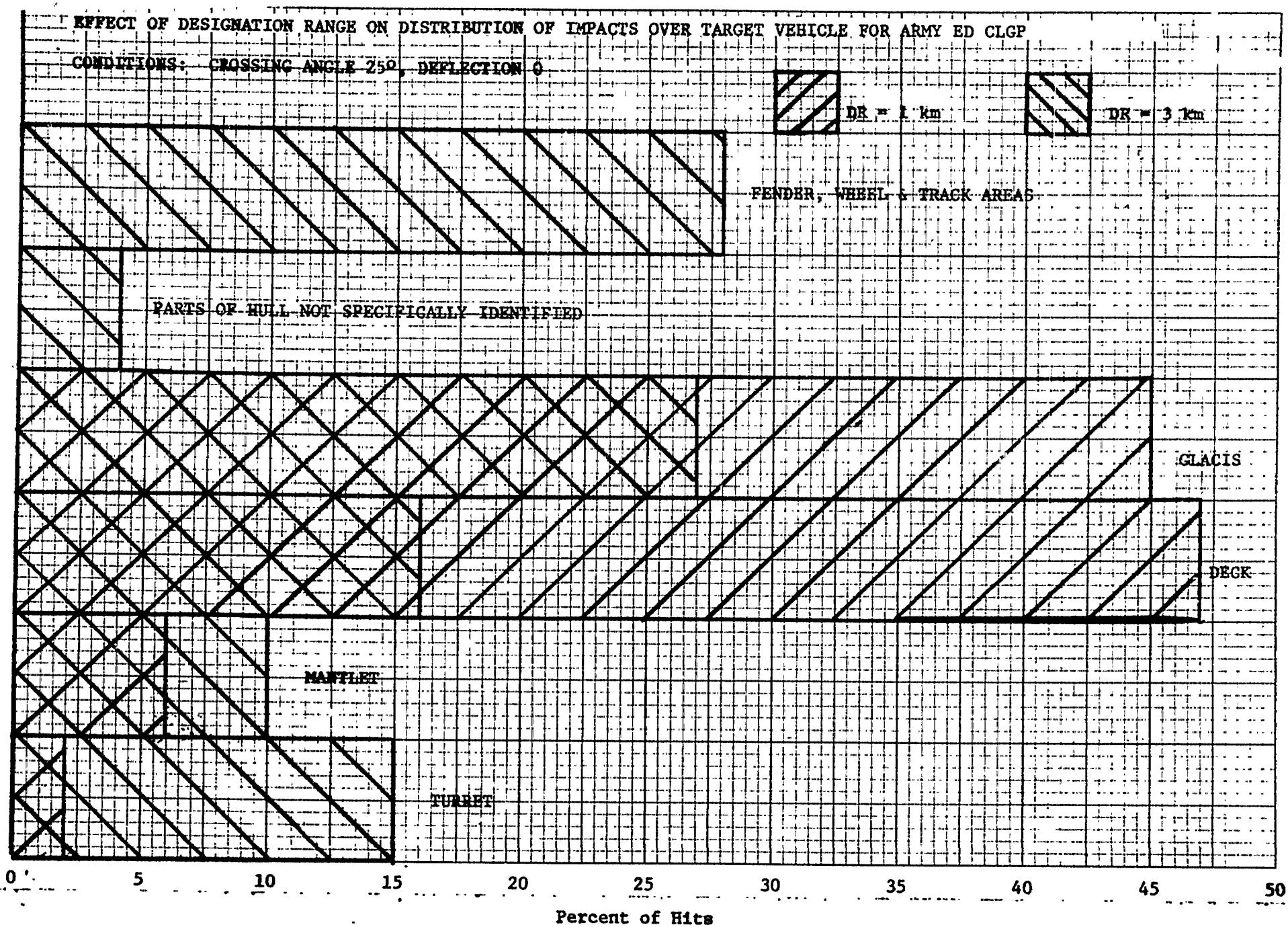

Figure 4. Effect of Designation Range on the Distribution of Impacts

The dispersion in impact obliquity as well as yaw angle of attack increases somewhat with increase in target azimuth. Over the range of target azimuths frequently encountered operationally--25 to 35 deg--the distribution in impact obliquity is independent of azimuth for both Army and Navy systems. See Table 7C.

A weighted average of obliquities over all parameters shows that the differences in obliquity between systems is not great. Both systems have about the same median (within 2 deg) and identical interquartile range. The upper tail of the obliquity probability density function appears somewhat more extensive for the Navy system. However, in view of the magnitude of the effects of other parameters, the system effect is not operationally significant.

VERIFICATION OF COMPUTER MODELS

To assure that the obliquities computed by DRSAR-SA using the SA target model were correct, i.e., free of computational errors, and to be able to infer the consequences for impact obliquity of changes in the geometry of the target, it was important to have other investigators of this subject perform an independent analysis. As indicated earlier, DRSAR-SA had been working with members of the Physics Team of the Rodman Laboratories. This group--Amoruso, DeYoung, and Morris--had prepared all of the laser signatures using the ERIM target reflectivity model. The author asked Dr. Amoruso to consider using the target submodels--HIFAC and LOFAC--to compute obliquities for this study rather than to calculate laser signatures, which is the intended application of these models. The Physics Team agreed to modify the target models to calculate the angle between a given input vector and the normal to the surface facet which the vector initially intercepts. Additionally, a postprocessor computer program was written to calculate and display the obliquity statistics in a form comparable to our own.

To minimize confounding effects which would render comparison of model outputs difficult at best, the impact-plane statistics produced by the SA flight simulation, ZOT.14, were provided as input to all of the target models. All target models were properly indexed geometrically. Specifically, the center of aim for all models is as shown in Figure 5. Additionally, the center of impacts for all models was identical. Impact obliquities reported by the postprocessor for each target model were compared point by point to eliminate the possibility that grossly different target plane impacts had occurred. To facilitate comparison of results, each model reported identical statistics and in the same format. Examples of postprocessor outputs are shown in Figures 6 thru 11. In these figures the results of experiment 491 are displayed using both the HIFAC and LOFAC target models. A three-way comparison of HIFAC, LOFAC, and SA models was performed using data from the following experiments: 491, 492, 493, 497, and 505. See Table 1 for interpretation of experiment numbers. For all other experiments only the results from the LOFAC and SA models were obtained. All the results obtained by the Physics Team at Rodman [4] are in the Appendix A of this note.

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[4]Unpublished results from Rodman Laboratories, Physics Team, SARRI-R, 31 May 76, subject: Results for Obliquity Study--Comparison with ZOT.14

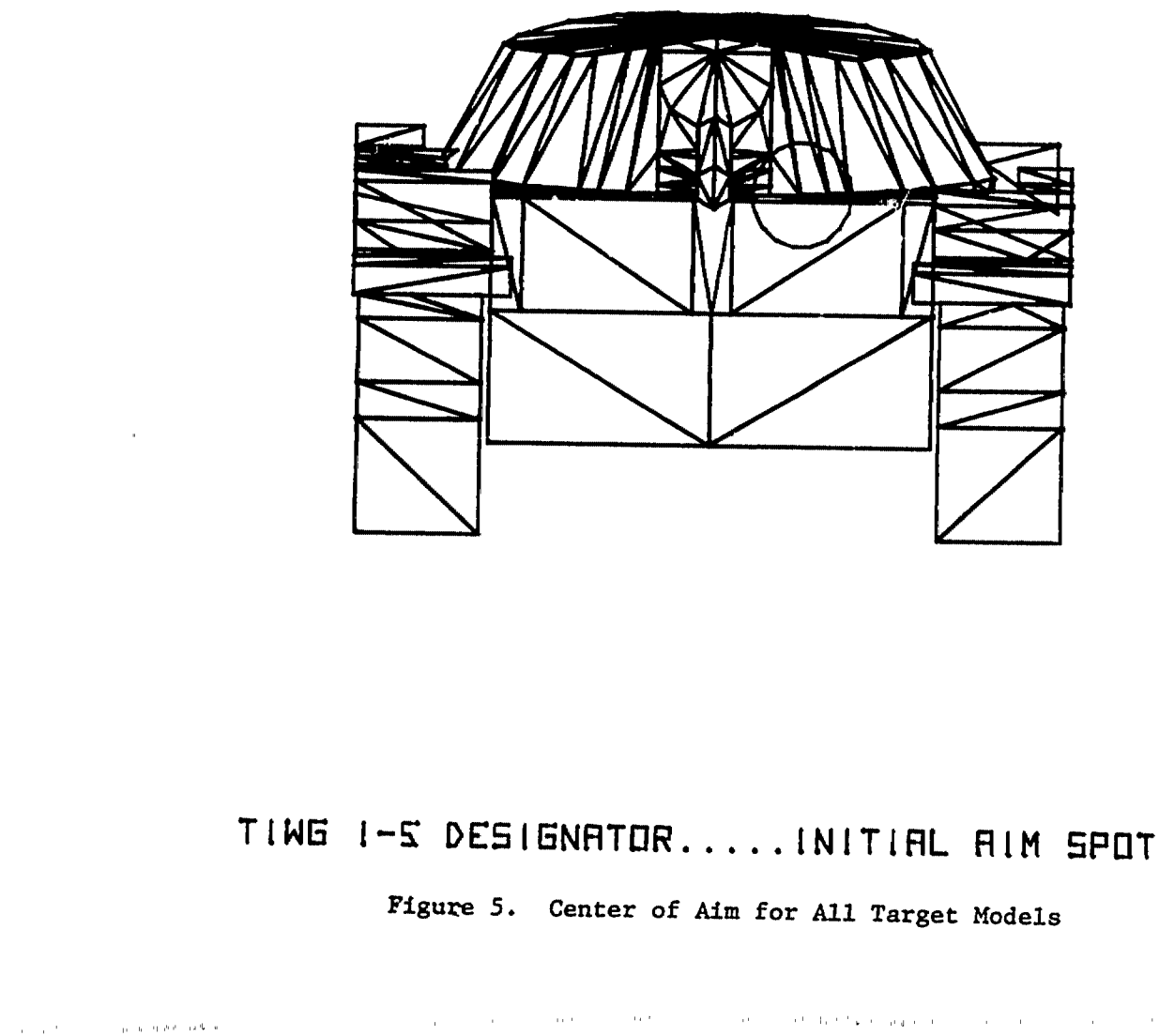

Figure 5. Center of Aim for All Target Models

RODMAN LAB-PHYSICS

HIFAC COMPARISON WITH ZOT.14 RUN 491 PAGE 1

THERE WERE 0 MISSES

THEY WERE REPS #:

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

38	4.0902	56	45.1309	3	54.0046	36	62.6741	7	71.8092
9	8.8799	83	45.3577	71	54.2424	44	63.0354	26	71.8401
78	10.8549	70	45.9357	27	54.4544	72	63.2242	23	72.2268
62	19.2578	31	46.4452	51	54.5503	50	63.9030	37	72.4793
65	24.7089	49	47.5676	12	55.1322	82	64.0855	41	73.4170
19	24.9656	81	48.2593	48	55.2345	11	64.9787	69	74.5630
39	25.7328	75	48.4514	79	55.6472	6	66.4740	68	74.6205
46	30.1041	34	48.4882	61	55.7017	15	66.8620	5	74.9739
1	31.9493	60	48.8961	21	56.7631	20	67.5250	22	76.2830
43	32.8478	57	49.3113	74	57.3926	47	67.9636	8	77.0774
77	36.1319	42	49.9366	2	58.1233	18	68.1801	33	78.4471
76	38.3001	28	50.0541	80	58.2269	24	68.7220	40	79.0161
59	40.2723	63	51.7254	64	58.9939	45	69.0033	32	81.4444
30	43.2223	53	52.5320	16	59.5320	35	69.5408	14	81.5105
73	43.9422	52	53.0874	10	61.1110	4	70.1904	55	83.4481
54	44.4347	29	53.6036	17	61.3986	13	71.0313		
25	44.9036	58	53.6299	66	61.4910	67	71.4947		

OBLIQUITY MEAN 55.3863 DEG, STANDARD DEVIATION 17.0987 DEG

PERCENTILES:

RANK	DEVIATE
0.05	20.35
0.10	30.84
0.15	39.48
0.20	44.81
0.25	46.45
0.30	48.57
0.35	50.72
0.40	53.62
0.45	54.53
0.50	55.70
0.55	58.38
0.60	61.44
0.65	63.63
0.70	66.78
0.75	68.72
0.80	71.12
0.85	72.33
0.90	74.83
0.95	78.90

Figure 6. Sample Postprocessor Statistics Using the HIFAC Target Model

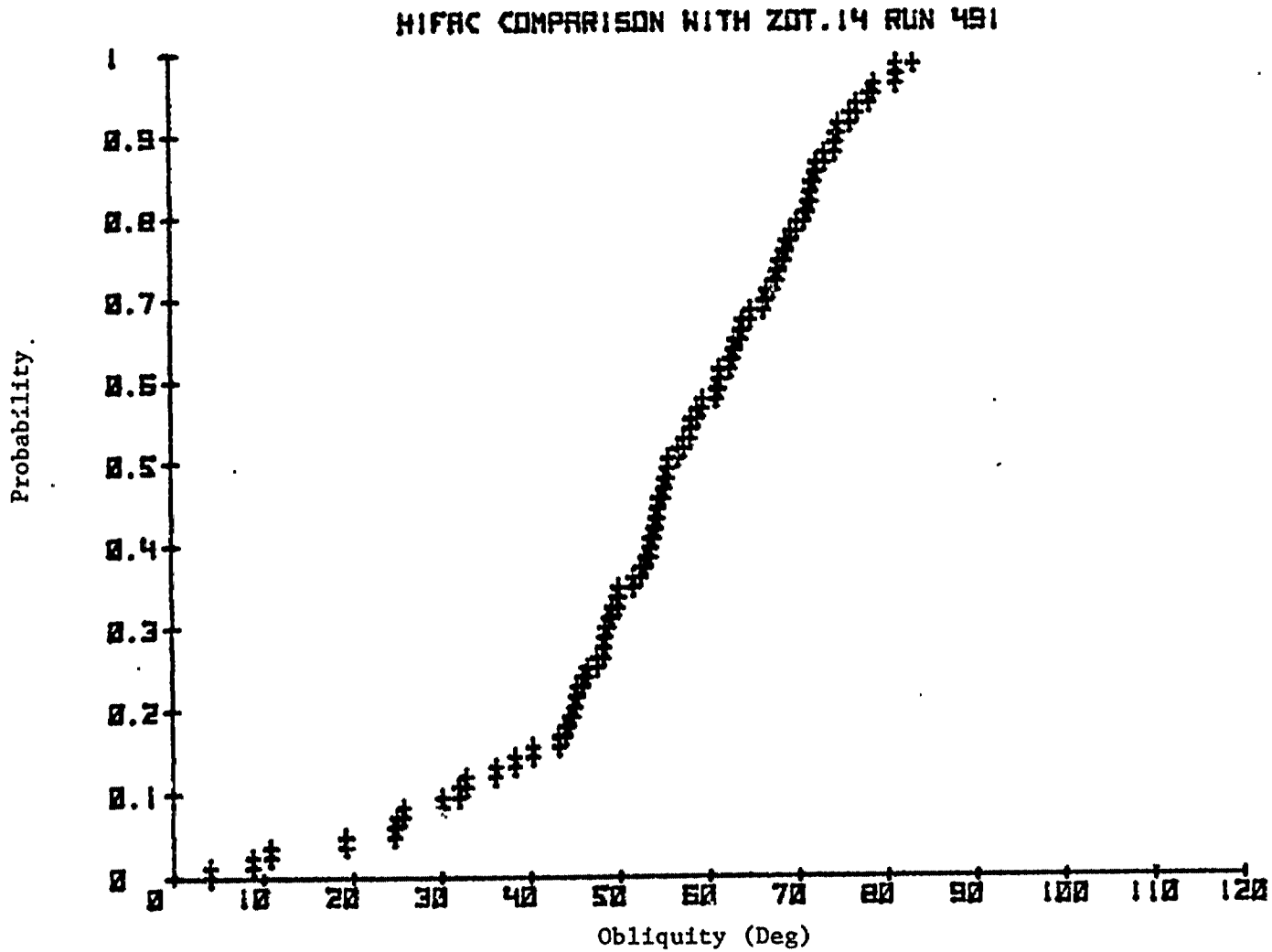

Figure 7. Sample Cumulative Distribution Function of Impact Obliquity Using the HIFAC Model

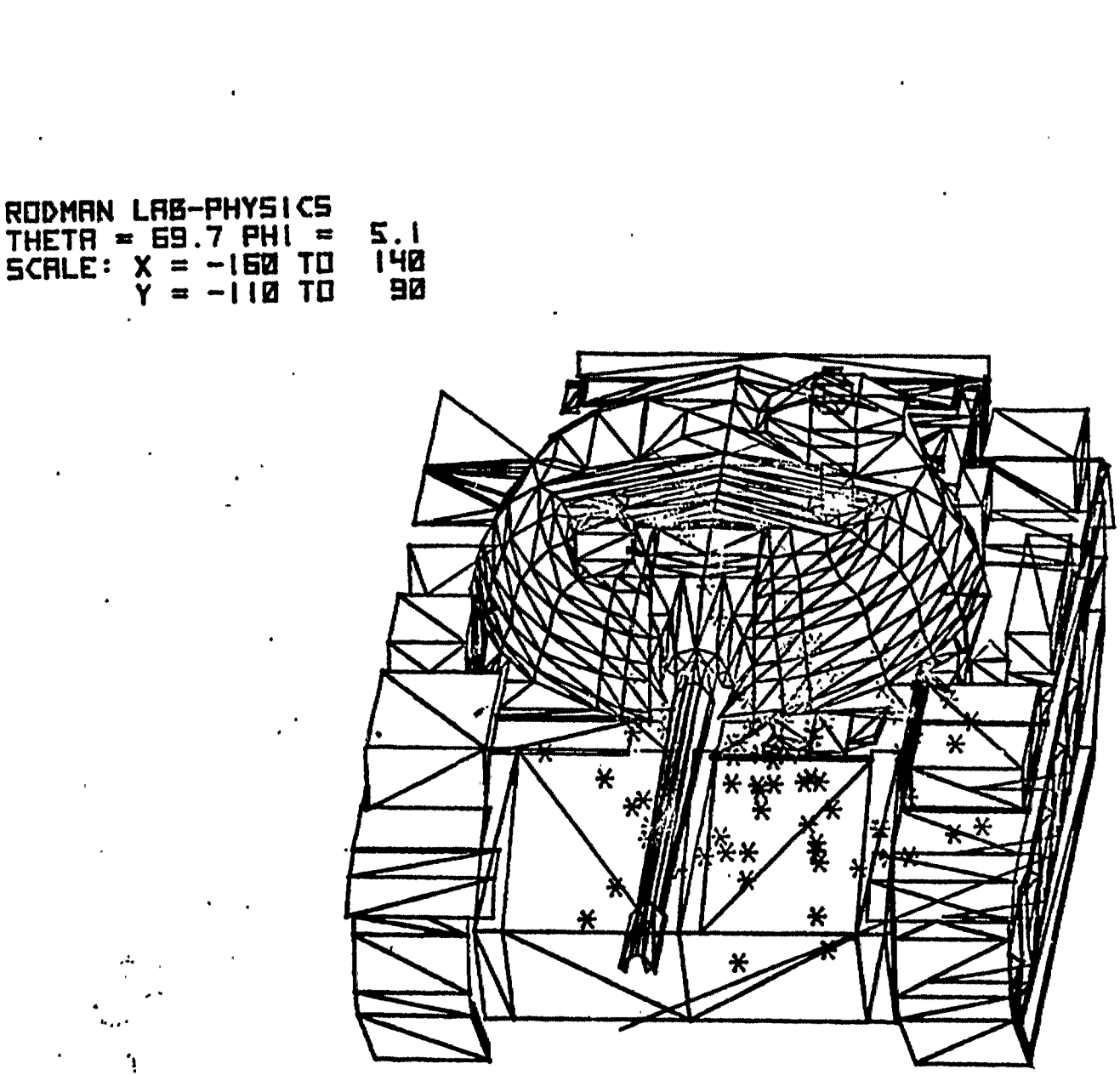

Figure 8. Sample of Target-Plane Impacts Using the HIFAC Model

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 491 PAGE 1

THERE WERE 0 MISSES

THEY WERE REPS #:

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

78	5.6394	31	45.9553	48	55.2345	44	63.0354	7	71.8092
9	11.5741	30	46.3390	12	55.3338	72	63.2242	26	71.8401
43	19.3003	49	47.5676	79	55.6472	50	63.9030	1	72.3639
23	19.9028	81	48.2593	61	55.7017	82	64.0855	54	72.3918
38	22.3769	33	48.4468	51	55.9481	11	64.9787	37	72.4793
13	25.5265	75	48.4514	21	56.7631	15	66.8620	40	73.0169
65	32.8361	34	48.4882	25	57.1706	20	67.5250	41	73.4170
28	34.2367	60	48.8961	80	58.2269	47	67.9636	69	74.5630
62	36.0275	74	49.4344	77	58.4287	18	68.1801	68	74.6205
46	36.8677	57	49.5663	64	59.1858	24	68.7220	32	74.7286
39	39.3077	42	50.1422	63	59.1971	45	69.0033	5	74.9739
59	40.2723	53	52.5320	16	59.5320	35	69.5408	22	76.2830
76	42.9407	52	53.2934	10	61.3173	4	70.1904	8	77.0774
73	44.1520	58	53.6299	17	61.3986	14	70.4855	2	79.9577
56	45.3398	29	53.8126	66	61.4910	6	70.6773	55	83.4481
83	45.3577	3	54.0046	19	61.8142	67	71.4947		
70	45.9357	71	54.2424	36	62.6741	27	71.6130		

OBLIQUITY MEAN 56.2672 DEG, STANDARD DEVIATION 16.0152 DEG

PERCENTILES:

RANK	DEVIATE
0.05	20.40
0.10	34.95
0.15	41.87
0.20	45.82
0.25	48.26
0.30	49.00
0.35	52.84
0.40	54.15
0.45	55.69
0.50	58.23
0.55	59.89
0.60	62.16
0.65	64.01
0.70	67.88
0.75	69.54
0.80	71.52
0.85	72.38
0.90	74.10
0.95	76.02

Figure 9. Sample Postprocessor Statistics Using the LOFAC Target Model

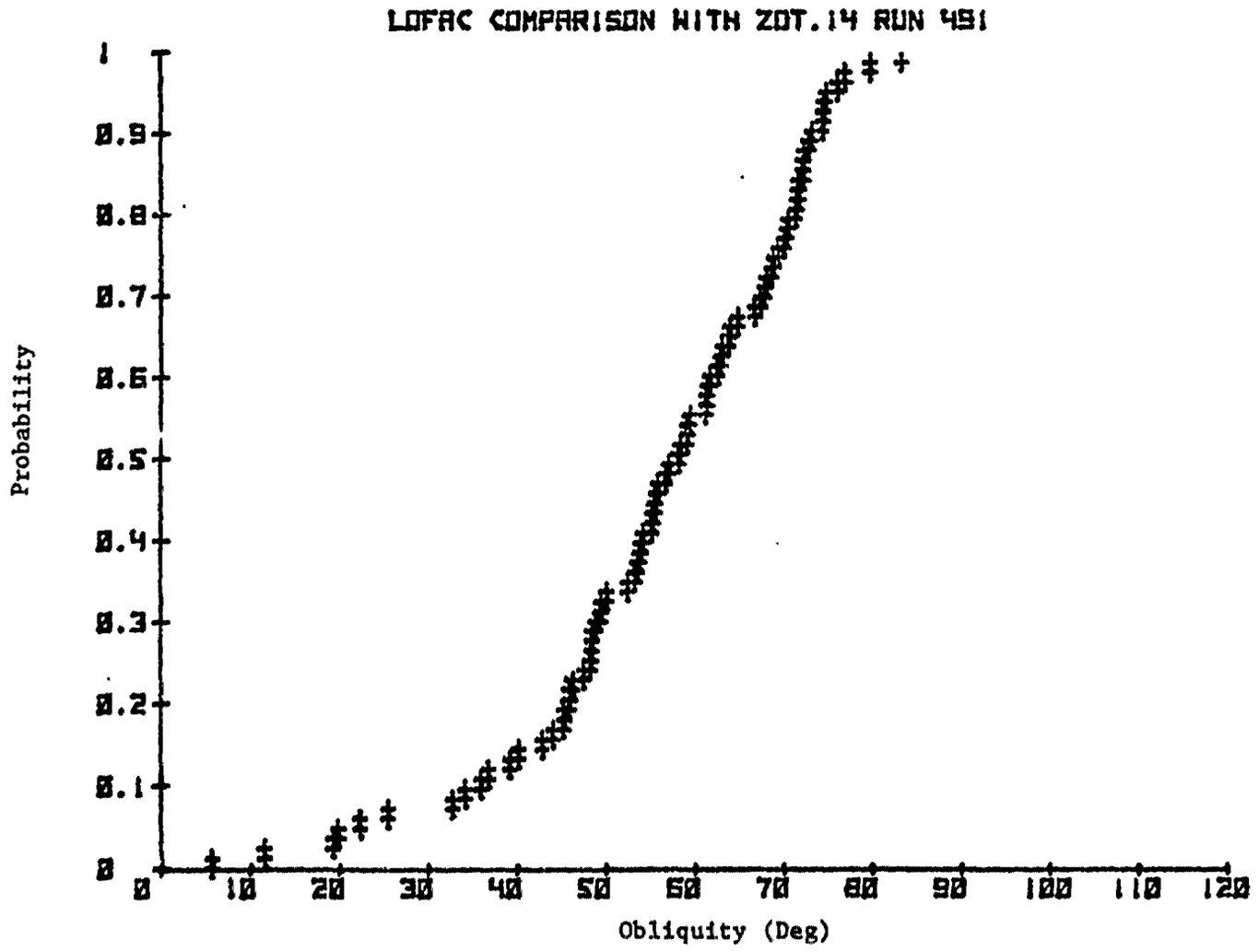

Figure 10. Sample Cumulative Distribution Function of Impact Obliquity Using the LOFAC Model

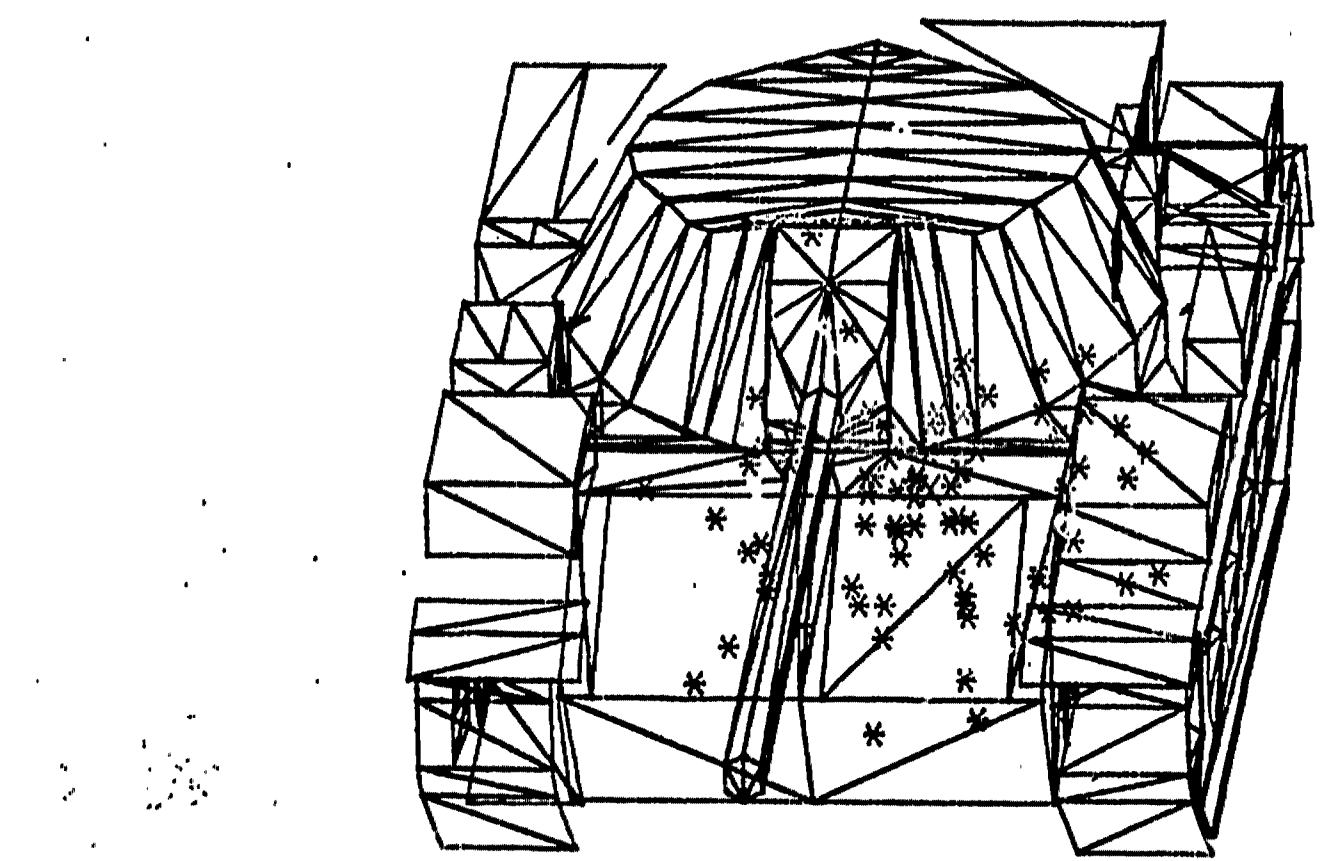

Figure 11. Sample of Target-Plane Impacts Using the LOFAC Model

In spite of the apparent differences in the target geometry represented by the HIFAC, LOFAC, and SA models, the estimated distribution functions for impact obliquity are surprisingly similar. Using the HIFAC results as a base, differences in the obliquity percentiles were taken for each run and are selectively displayed in Figures 12 thru 15. One feature that is common to all the comparisons is the overestimate in the percentile values below the 20 th for both the LOFAC and SA models. As shown in Figures 12 and 13 for Run 497, the LOFAC and SA models underestimate the probability invested in the lower tail of the probability density function. Consequently, relative to the HIFAC results, the simpler target models tend to overestimate the lower percentiles. However, for percentiles above the 20 th, approximately, the differences in percentile values are generally 2 to 3 degrees. Similar results are shown for Run 505 in Figures 14 and 15. One must conclude that a highly-faceted target model is a requisite for accuracy only if one is concerned with the lower tail of the distribution of obliquity, viz, below the 15 or 20 th percentile. One may also infer that slight departures from the basic geometry of a particular target vehicle--of the sort examined here--will not significantly affect the major portion of the distribution of impact obliquity.

CONCLUSIONS AND RECOMMENDATIONS

The interpretations of important results discussed above are summarized here. Both guidance accuracy and impact angle of attack are most strongly affected by designation range (or, alternatively, the magnitude of apparent laser spot jitter). It is noted that the distribution of impact obliquity is a function of characteristics of the operational scenario. Such parameters as designation range, target azimuths relative to the designator and relative to the seeker (affecting laser signature), and the initial deflection of the target relative to the direction of fire all affect the distribution of obliquity. However, when a representative universe of engagements is considered, the averaged obliquity distributions for the two projectile systems--Army and Navy--do not differ significantly. Both systems exhibit median obliquities between 55 and 60 degrees with a 25 degree interquartile range. There is a somewhat greater than 10% likelihood that a guided projectile will impact with an obliquity in excess of 75 degrees. This fact may be important to the selection of a fuzing system. If surface wave sensors are not employed as part of the fuzing system, it appears that warhead function will suffer by dudding and non-optimally delayed action. This issue merits additional investigation by experts in terminal effects. It is suggested that the results of the present study be used in a detailed analysis of the lethal effects of CLGP.

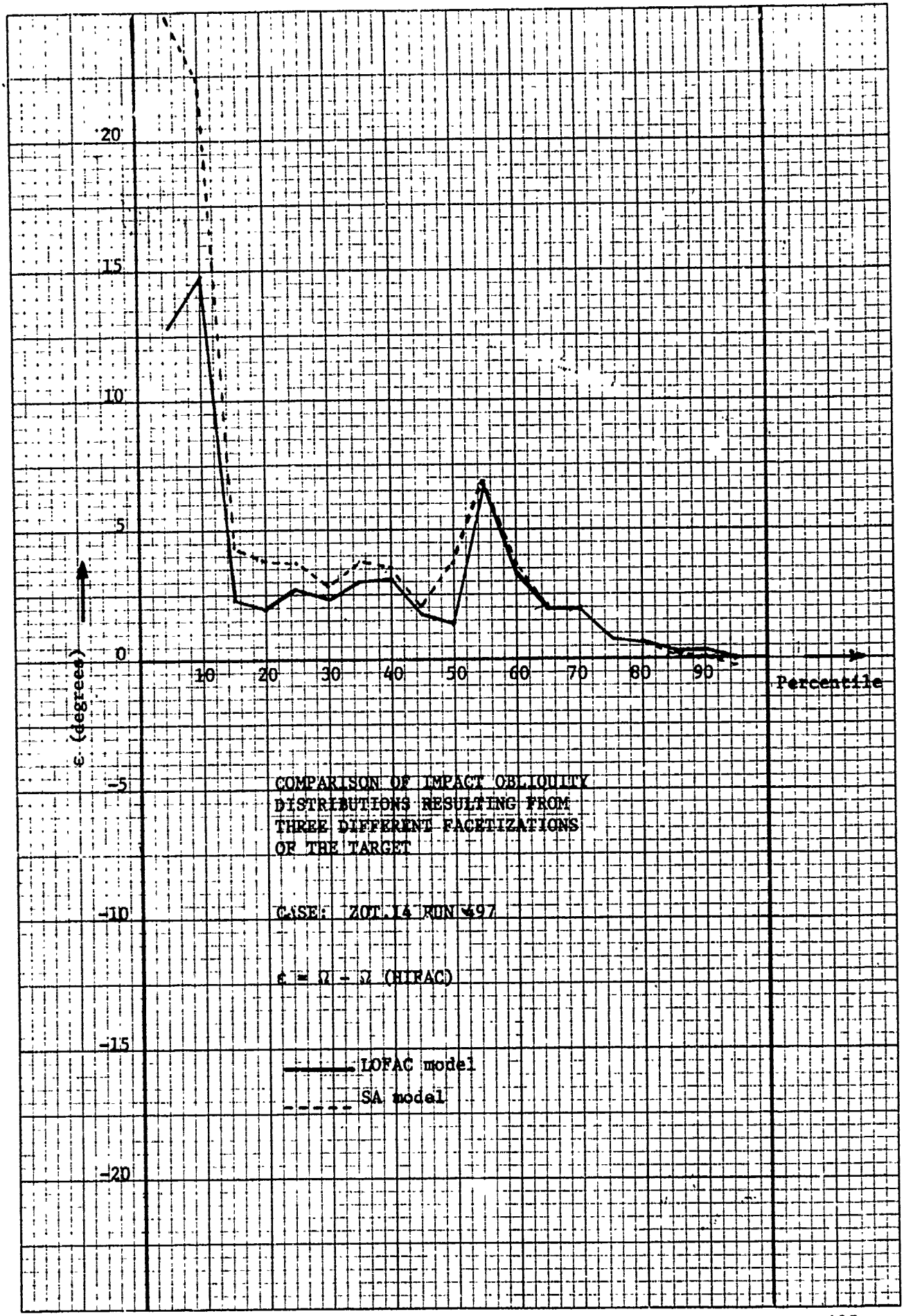

Figure 12. Differences in Obliquity Percentiles Between Target Models for Run 497

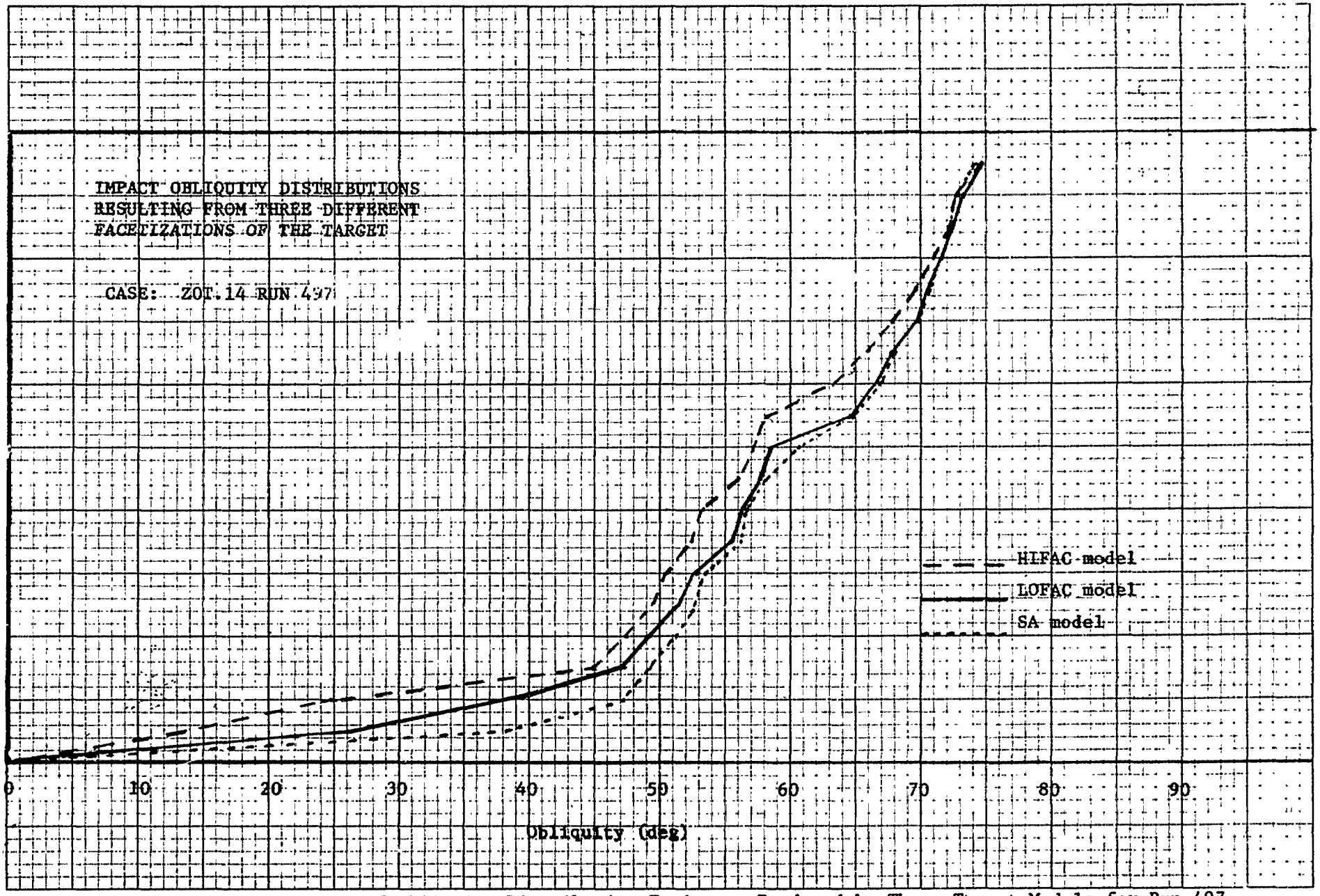

Figure 13. Comparisons of Obliquity Distribution Estimates Produced by Three Target Models for Run 497

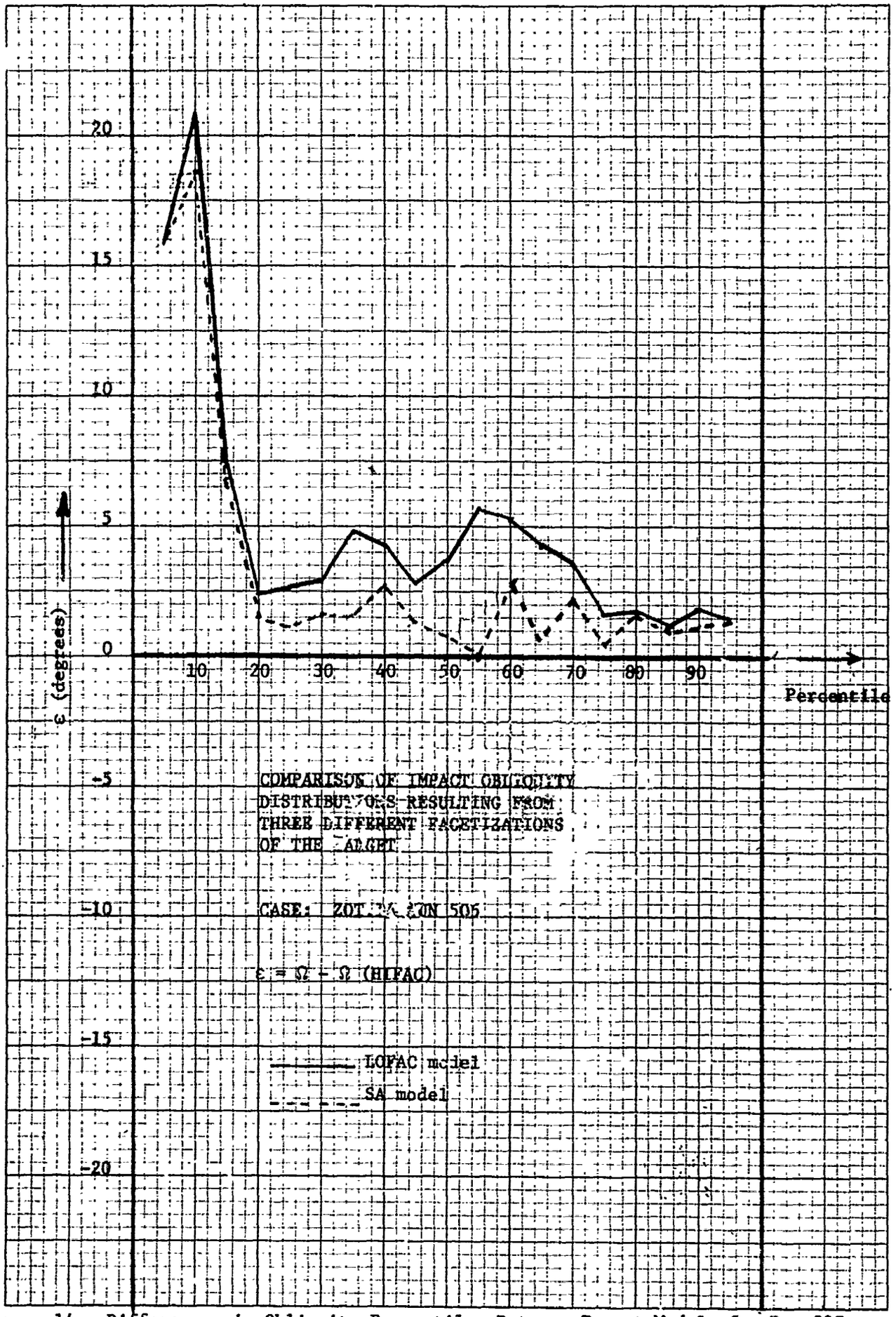

Figure 14. Differences in Obliquity Percentiles Between Target Models for Run 505

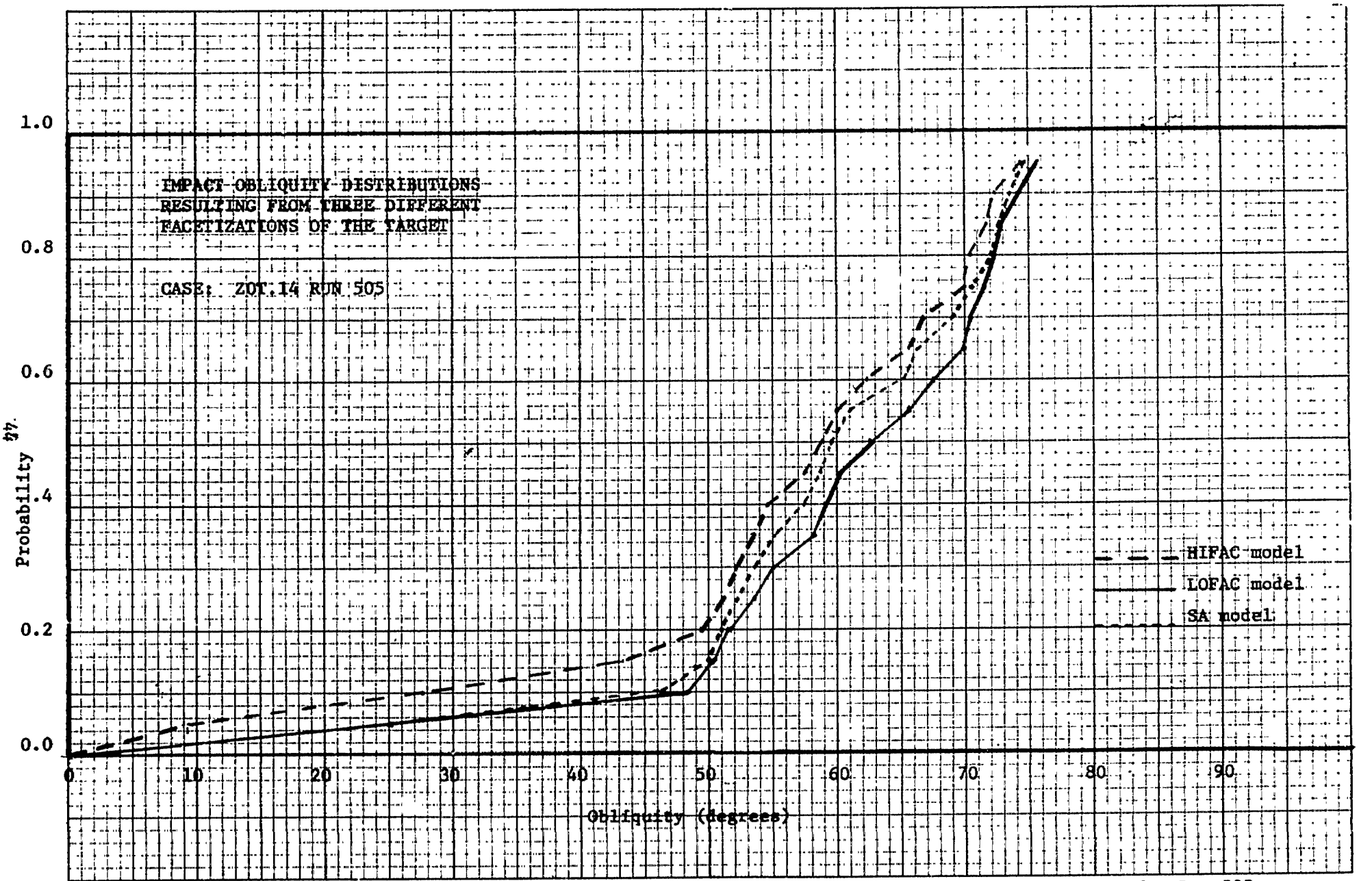

Figure 15. Comparison of Obliquity Distribution Estimates Produced by Three Target Models for Run 505

APPENDIX A

RODMAN LABORATORY RESULTS FOR OBLIQUITY STUDY

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THERE WERE 0 MISSES

THEY WERE REPS #:

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

78	5.6394	31	45.9553	48	55.2345	44	63.0354	7	71.8092
9	11.5741	30	46.3350	12	55.3338	72	63.2242	26	71.8401
43	19.3003	49	47.5676	79	55.6472	50	63.9030	1	72.3639
23	19.9028	81	48.2593	61	55.7017	82	64.0855	54	72.3918
38	22.3769	33	48.4468	51	55.9481	11	64.9787	37	72.4793
13	25.5265	75	48.4514	21	56.7631	15	66.8620	40	73.0169
65	32.8361	34	48.4882	25	57.1706	20	67.5250	41	73.4170
28	34.2367	60	48.8961	80	58.2269	47	67.9636	69	74.5630
62	36.0275	74	49.4344	77	58.4287	18	68.1801	68	74.6205
46	36.8677	57	49.5663	64	59.1858	24	68.7220	32	74.7286
39	39.3077	42	50.1422	63	59.1971	45	69.0033	5	74.9739
59	40.3723	53	52.5039	16	59.5320	35	69.5408	22	76.2830
76	42.9407	52	53.2934	10	61.3173	4	70.1904	8	77.0774
73	44.1520	58	53.6299	17	61.3986	14	70.4855	2	79.9577
56	45.3398	29	53.8136	66	61.4910	6	70.6773	55	83.4481
83	45.3577	3	54.0046	19	61.8142	67	71.4947		
70	45.9357	71	54.2424	36	62.6741	27	71.6130		

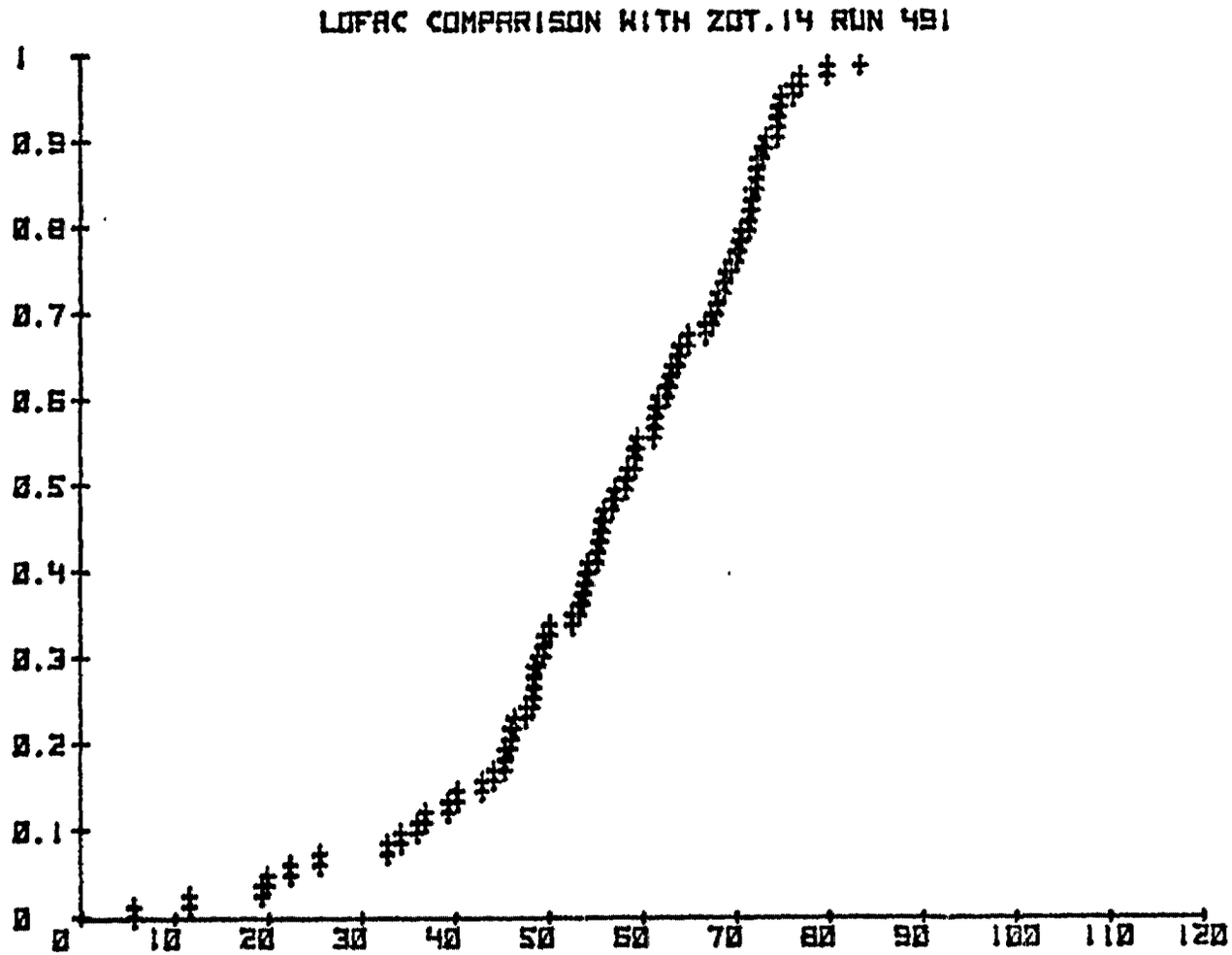
OBLIQUITY MEAN 56.2672 DEG: STANDARD DEVIATION 16.0152 DEG

PERCENTILES:

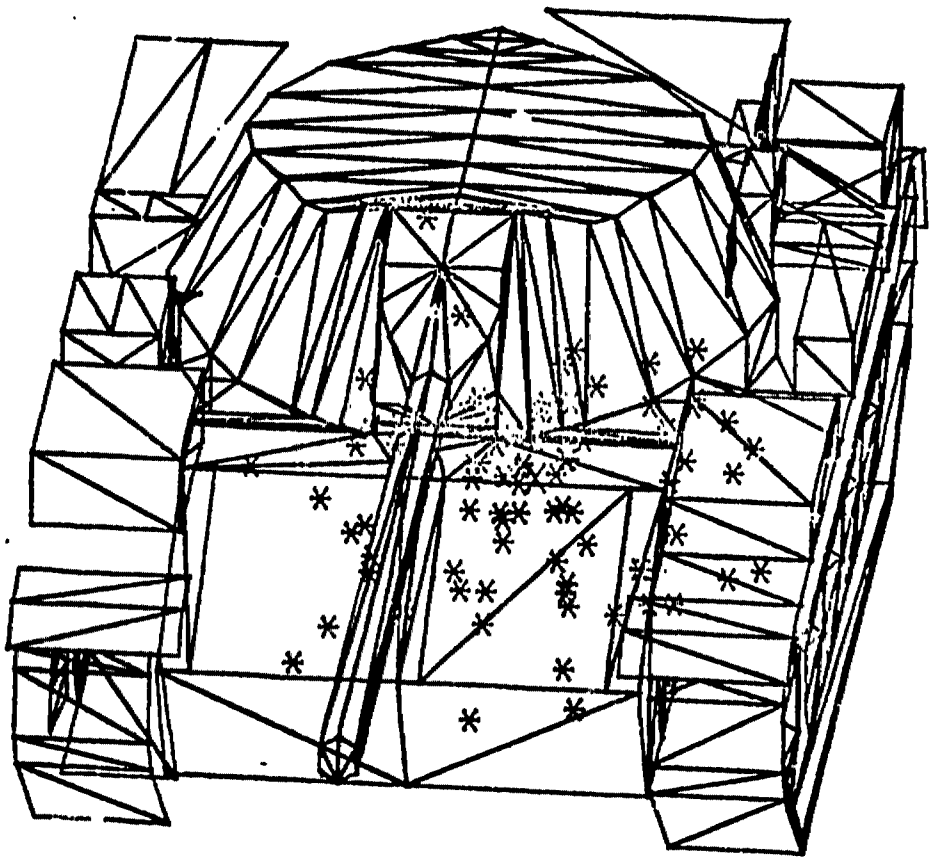
RANK	DEVIATE
0.05	20.40
0.10	34.95
0.15	41.87
0.20	45.82
0.25	48.26
0.30	49.00
0.35	52.84
0.40	54.15
0.45	55.69
0.50	58.23
0.55	59.09
0.60	62.16
0.65	64.01
0.70	67.88
0.75	69.54
0.80	71.52
0.85	72.38
0.90	74.10
0.95	76.02

LOFAC COMPARISON WITH ZOT.14 RUN 491

FACET NO.	NO. OF IMPACTS
136	19
231	14
-136	6
178	6
238	3
-286	2
-231	2
134	2
135	2
144	2
146	2
234	2
235	2
240	2
274	2
283	2
-290	1
-278	1
-288	1
-282	1
-137	1
182	1
233	1
241	1
242	1
244	1
246	1
277	1
284	1


LOFAC COMPARISON WITH ZOT.14 RUN 491
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 69.7 PHI = 5.1
SCALE: X = -160 TO 140
Y = -110 TO 90



LOFAC COMPARISON WITH ZOT.14 RUN 491

THERE WERE 0 MISSES

THEY WERE REPS #:

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

38	4.0902	56	45.1309	3	54.0046	36	62.6741	7	71.8092
9	8.8799	83	45.3577	71	54.2424	44	63.0354	26	71.8401
78	10.[illegible]749	79	45.9057	27	54.4544	72	63.2242	23	72.2268
62	19.2578	31	46.4452	51	54.5503	50	63.9030	37	72.4793
65	24.7089	49	47.5675	12	55.1323	82	64.0855	41	73.4170
19	24.9656	81	48.2593	48	55.2345	11	64.9787	69	74.5630
39	25.7326	75	48.4514	79	55.6472	6	66.4740	68	74.6205
46	30.1041	34	48.4882	61	55.7017	15	66.8620	5	74.9739
1	31.9493	60	48.8951	21	56.7631	20	67.5250	22	76.2830
43	32.8478	57	49.3113	74	57.3926	47	67.9636	8	77.0774
77	36.1319	42	49.9366	2	58.1233	18	68.1801	33	78.4471
76	38.3001	28	50.0541	80	58.2269	24	68.7220	40	79.0161
59	40.2723	63	51.7254	64	58.9939	45	69.0036	32	81.4444
30	43.2223	53	52.5320	16	59.5320	35	69.5408	14	81.5195
73	43.9422	52	53.0874	10	61.1110	4	70.1904	55	83.4481
54	44.4347	29	53.6036	17	61.3986	13	71.0313		
25	44.9036	58	53.6299	66	61.4910	67	71.4947		

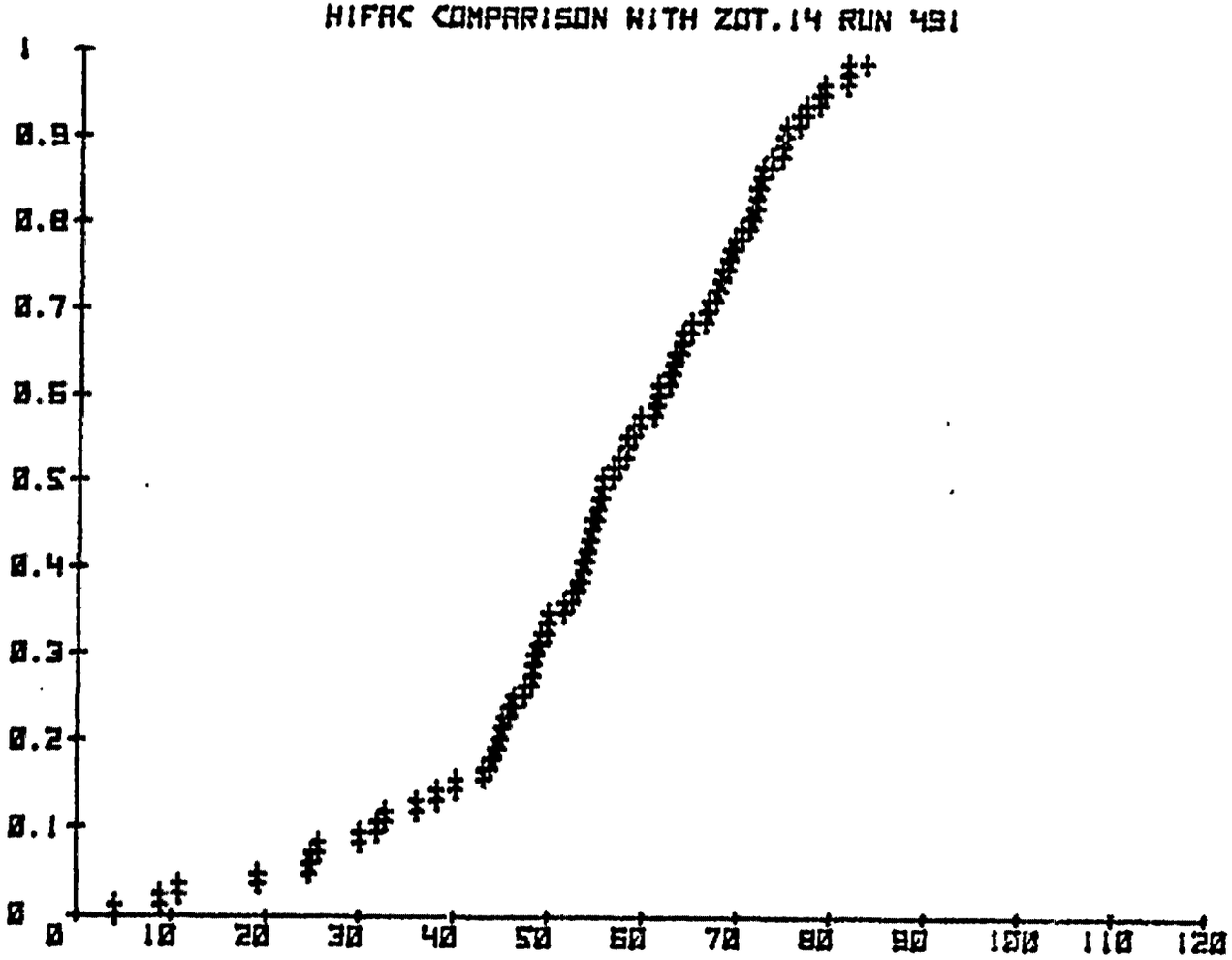
OBLIQUITY MEAN 55.3863 DEG, STANDARD DEVIATION 17.0987 DEG

PERCENTILES:

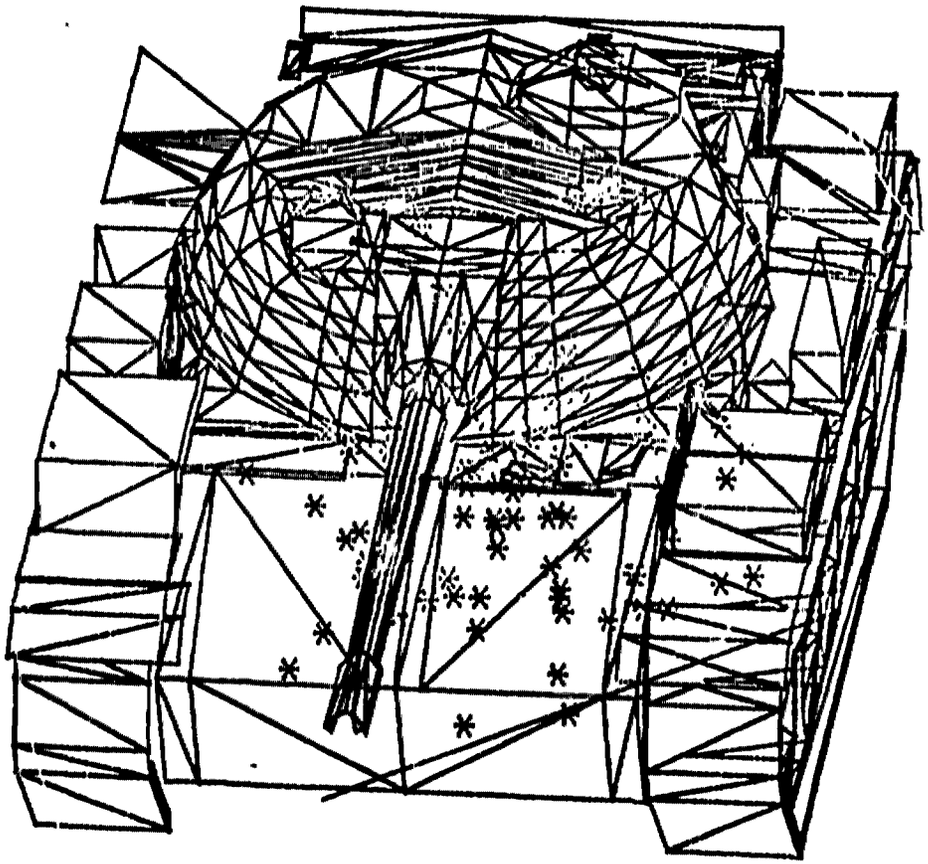
RANK	DEVIATE
0.05	20.35
0.10	30.84
0.15	39.48
0.20	44.81
0.25	46.45
0.30	48.57
0.35	50.72
0.40	53.62
0.45	54.53
0.50	55.70
0.55	58.38
0.60	61.44
0.65	63.63
0.70	66.78
0.75	68.72
0.80	71.12
0.85	72.33
0.90	74.83
0.95	78.90

HITAC COMPARISON WITH 201.14 RUN 491

FACET NO.	NO. OF IMPACTS
399	20
-300	7
171	3
254	3
256	3
333	3
395	3
-308	2
-161	2
180	2
182	2
255	2
307	2
311	2
387	2
522	2
-309	1
-306	1
-305	1
-163	1
-160	1
99	1
100	1
103	1
161	1
162	1
189	1
196	1
263	1
264	1
285	1
287	1
288	1
308	1
310	1
317	1
332	1
472	1
520	1


HIFRC COMPARISON WITH ZOT.14 RUN 491
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 69.7 PHI = 5.1
SCALE: X = -160 TO 140
Y = -110 TO 90



HIFAC COMPARISON WITH ZOT.14 RUN 491

RODMAN LAB-PHYSICS

LOFAL COMPARISON WITH ZOT.14 RUN 492 PAGE 1

THERE WERE 3 MISSES

THEY WERE REPS #: 49 60 72

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

11	12.3661	38	44.3167	73	53.1579	6	61.8187	1	70.9384
5	15.2613	41	45.3647	54	53.3320	18	63.2672	28	71.6933
4	23.3333	85	46.0948	14	54.4112	17	63.8832	84	71.8610
25	24.7429	78	46.9699	55	54.8176	19	64.9953	39	73.2484
45	25.5569	3	47.1130	31	56.4685	12	65.1774	69	73.5984
81	28.7459	51	47.3670	53	57.7473	38	65.3363	42	74.0639
67	29.5334	36	48.3100	50	57.9954	22	65.5739	43	74.5600
15	29.7897	29	48.7101	68	58.6609	46	66.3233	21	76.5252
40	30.1709	30	49.7249	7	59.2264	34	68.1956	70	77.9920
79	31.5511	77	49.8700	37	59.3518	13	68.4778	71	78.0449
26	32.1314	82	49.9160	83	59.4334	87	68.6898	10	78.7438
80	34.8172	33	50.0819	32	59.4765	8	68.8414	20	82.9719
48	35.0254	35	50.1063	23	59.9867	21	68.9540	66	83.9454
64	36.8369	83	50.2701	2	60.7170	16	69.0009	57	97.1870
52	37.0498	44	50.8159	75	60.8447	65	69.1969		
61	37.3779	59	52.0289	82	61.7563	47	69.4550		
56	43.3138	76	53.0611	74	61.8159	9	70.5845		

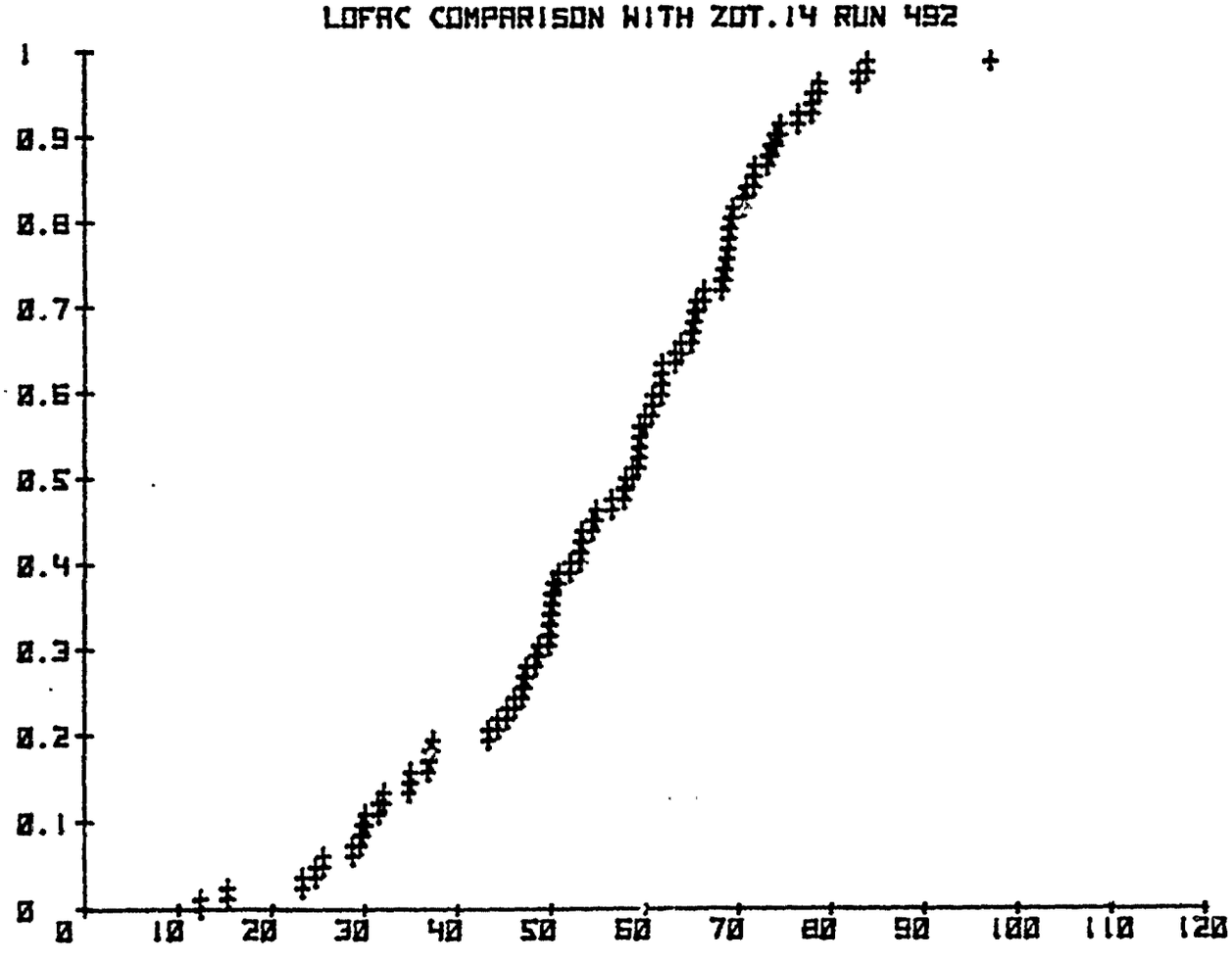
OBLIQUITY MEAN 55.4973 DEG. STANDARD DEVIATION 16.8579 DEG

PERCENTILES:

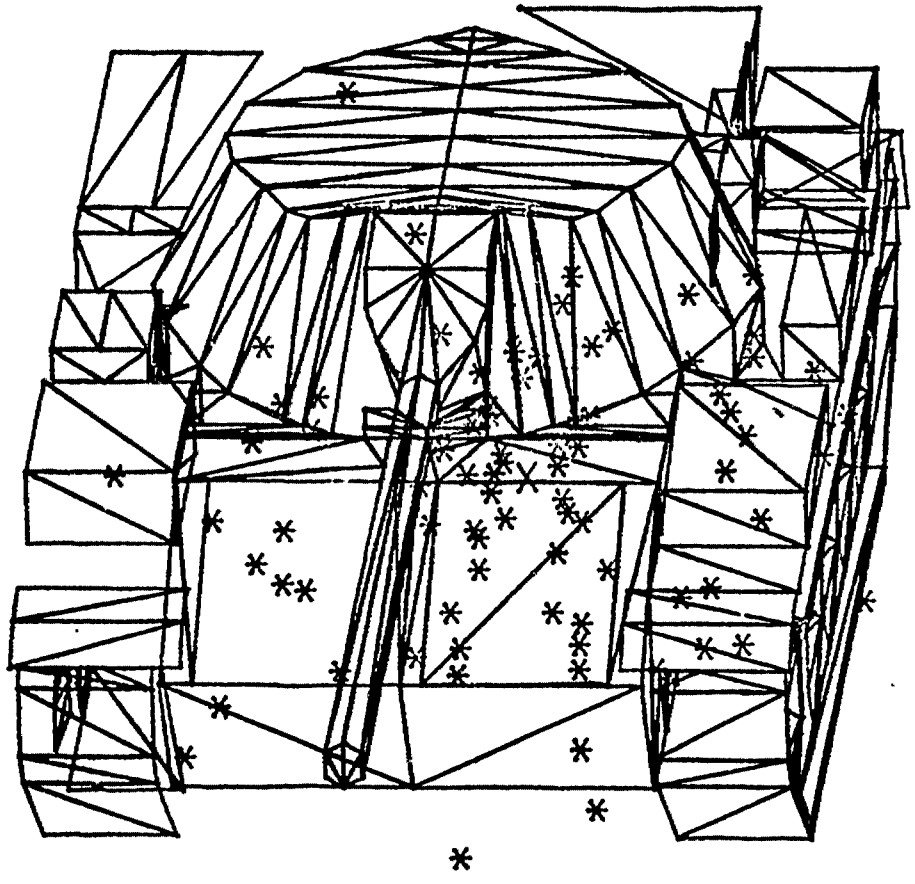
RANK	DEVIATE
0.05	24.87
0.10	29.90
0.15	34.91
0.20	40.94
0.25	46.67
0.30	48.67
0.35	50.08
0.40	52.24
0.45	54.55
0.50	58.33
0.55	59.46
0.60	61.57
0.65	63.85
0.70	65.65
0.75	68.73
0.80	69.30
0.85	71.79
0.90	74.41
0.95	78.64

LOFAC COMPARISON WITH TOT.14 RUN 492

FACET NO.	NO. OF IMPACTS
136	17
231	7
-136	6
178	4
142	3
242	3
-242	2
-134	2
137	2
232	2
238	2
241	2
254	2
274	2
-299	1
-296	1
-290	1
-238	1
-234	1
-231	1
28	1
122	1
134	1
144	1
146	1
179	1
182	1
187	1
197	1
234	1
235	1
237	1
239	1
246	1
249	1
253	1
277	1
283	1
284	1
287	1


LOFAC COMPARISON WITH ZOT.14 RUN 492
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 69.7 PHI = 5.1
SCALE: X = -160 TO 140
Y = -110 TO 90



LOFAC COMPARISON WITH ZOT.14 RUN 492

THERE WERE 2 MISSES

THEY WERE REPS #: 60 72

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

5	7.6727	58	44.3163	54	53.3320	74	61.8159	28	71.6933
11	9.0822	35	44.9350	53	53.7208	6	61.8187	84	71.8610
67	22.0363	85	46.0848	14	54.4112	18	63.0575	39	73.2484
4	23.3333	3	47.1130	55	54.8176	19	64.9953	69	73.5984
25	23.8790	51	47.3670	59	55.9500	12	65.1774	42	74.0639
26	24.6570	33	47.4749	31	56.4685	38	65.3363	43	74.5600
80	26.3053	36	48.3100	21	57.3486	22	65.5739	34	76.2089
81	28.7459	29	48.7101	50	57.9954	46	66.1134	24	77.8945
15	29.7897	30	49.6771	32	58.0963	49	66.9245	70	77.9920
79	31.5511	77	49.8700	47	58.4026	65	67.2511	71	78.0449
45	35.3703	62	49.9160	68	58.6609	13	68.4778	10	78.7438
41	35.4861	83	50.2701	76	58.8942	37	68.6898	17	81.6760
52	37.0498	44	50.8159	63	59.4334	8	68.8414	20	82.9719
61	37.3779	40	51.2360	23	59.9867	16	69.0009	66	83.9454
64	41.0370	48	51.3324	2	60.7176	9	70.5845	57	94.2563
78	42.0997	27	53.0848	75	60.8447	1	70.9384		
56	43.3138	73	53.1579	82	61.7563	7	71.2842		

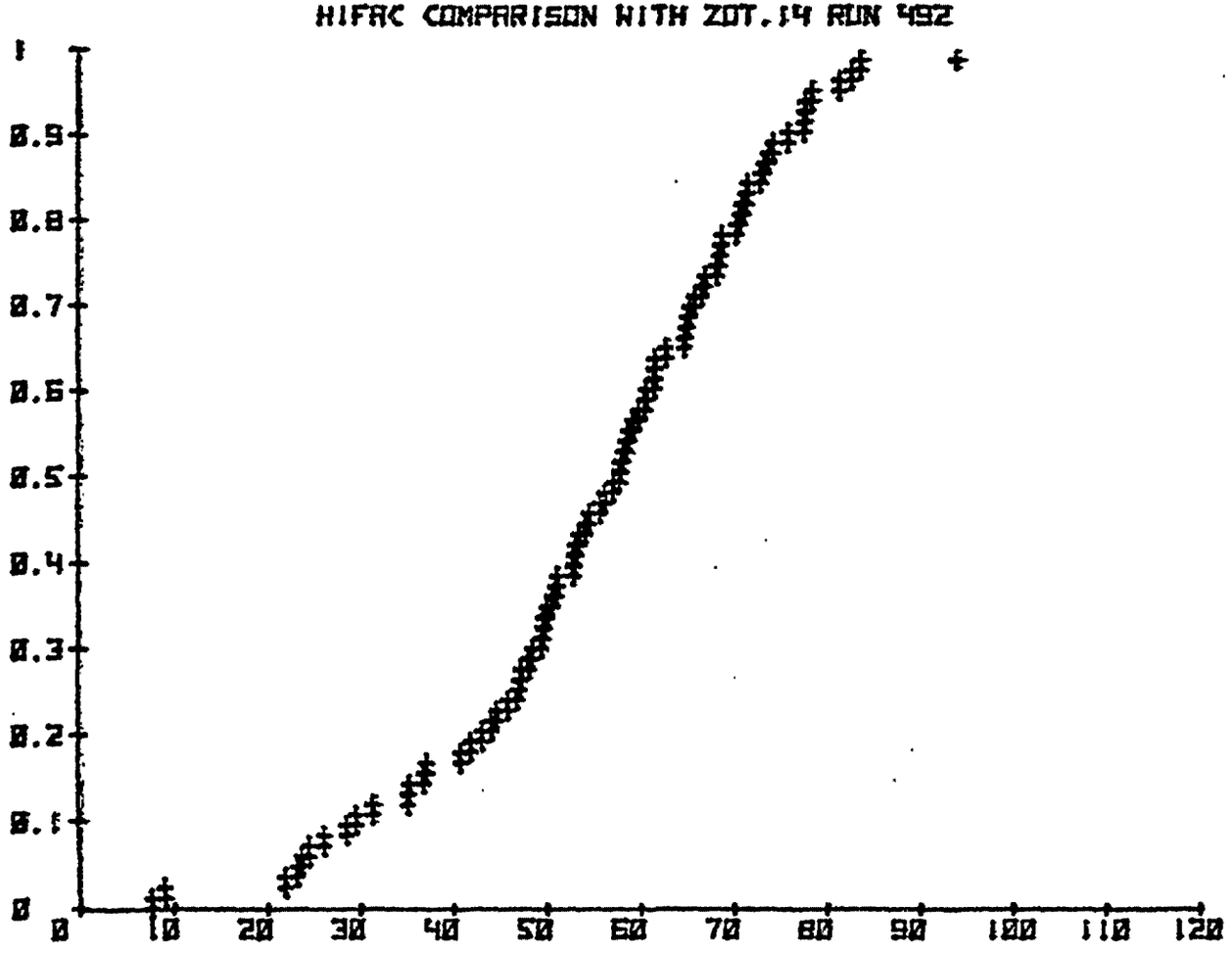
OBLIQUITY MEAN 55.6619 DEG, STANDARD DEVIATION 17.3903 DEG

PERCENTILES:

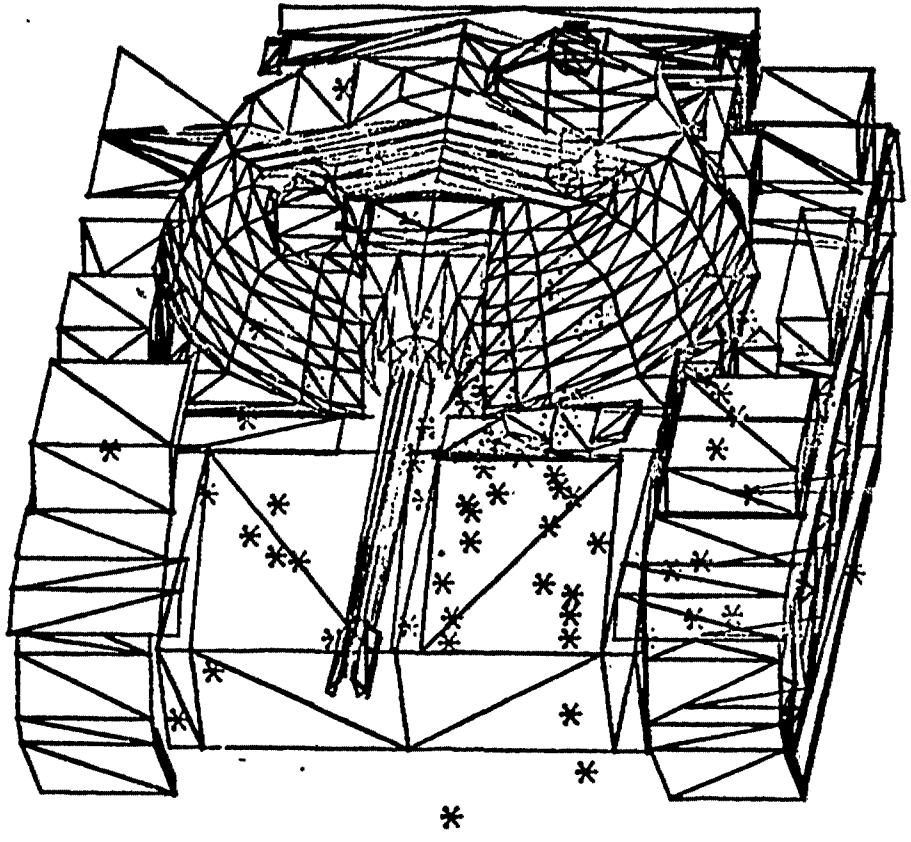
RANK	DEVIATE
0.05	23.44
0.10	29.16
0.15	36.42
0.20	43.07
0.25	47.11
0.30	48.90
0.35	50.49
0.40	53.13
0.45	54.74
0.50	58.00
0.55	59.00
0.60	61.21
0.65	64.22
0.70	66.01
0.75	68.69
0.80	71.01
0.85	73.39
0.90	77.22
0.95	81.09

HIFAC COMPARISON WITH ZOT.14 RUN 492

FACET NO.	NO. OF IMPACTS
399	17
-399	6
333	4
162	3
254	3
305	3
518	3
120	2
173	2
182	2
311	2
400	2
485	2
-367	1
-310	1
-305	1
-181	1
-179	1
-171	1
-160	1
74	1
84	1
100	1
102	1
171	1
172	1
184	1
195	1
198	1
200	1
206	1
255	1
256	1
306	1
337	1
347	1
386	1
387	1
388	1
474	1
520	1
522	1
529	1
599	1
673	1


HIFRC COMPARISON WITH ZOT.14 RUN 492
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 69.7 PHI = 5.1
SCALE: X = -160 TO 140
Y = -110 TO 90



HIFAC COMPARISON WITH ZOT.14 RUN 492

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 493 PAGE 1

THERE WERE 3 MISSES

THEY WERE REPS #: 59 75 78

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

81	8.5637	17	47.4430	60	59.3329	29	66.8230	37	78.1805
22	15.7236	70	47.6152	31	59.3534	57	67.8941	44	78.5826
8	16.4981	82	48.8908	11	59.7386	76	68.5205	20	79.2985
74	17.1330	83	49.1919	80	59.8009	69	69.2858	18	79.9784
32	18.6329	64	49.6188	15	59.8269	7	70.9869	72	81.1739
36	19.5645	67	49.9456	4	59.8928	84	71.1587	50	81.4046
48	19.6454	45	51.0152	23	60.2230	55	71.3633	1	81.9448
71	19.8391	63	51.4326	30	60.4968	25	72.1228	13	85.4025
21	19.8707	58	52.2913	43	61.0414	34	72.7580	6	85.7892
16	21.0447	68	53.5561	51	61.2044	54	72.7845	9	86.8519
33	22.3290	61	53.7436	46	61.7987	38	73.2719	85	89.6475
27	27.8406	12	54.2455	19	62.4561	28	73.8259	73	90.0054
47	29.7535	77	55.1137	79	63.0575	62	74.0084	49	90.6570
52	30.0951	10	56.4729	53	63.6513	24	74.4808	39	92.3329
35	34.9413	65	56.4852	66	63.9178	2	74.5393		
3	38.4857	56	57.2573	5	64.8395	42	74.7153		
14	39.3788	40	57.6788	41	66.7369	24	76.2192		

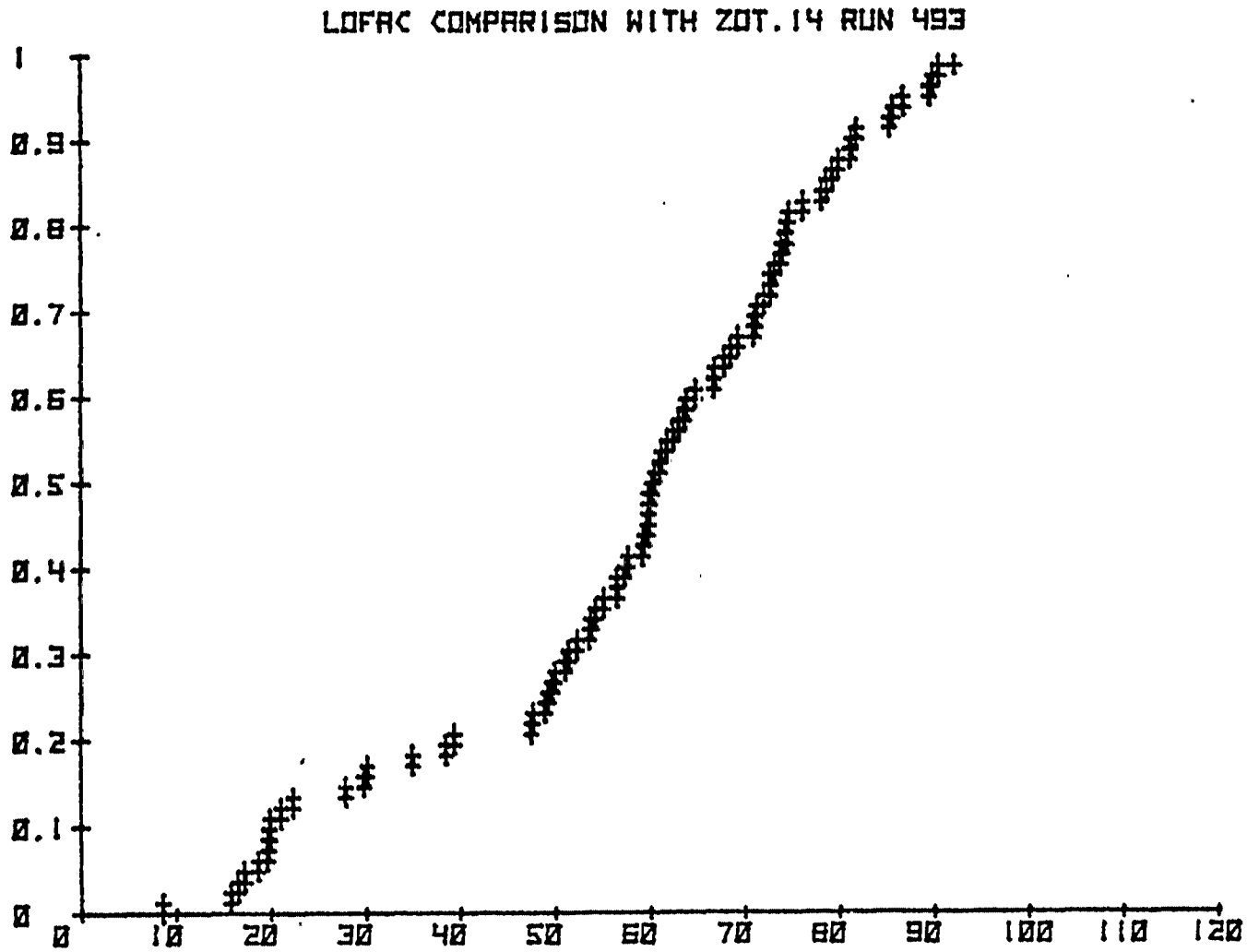
OBLIQUITY MEAN 57.8625 DEG, STANDARD DEVIATION 21.0641 DEG

PERCENTILES:

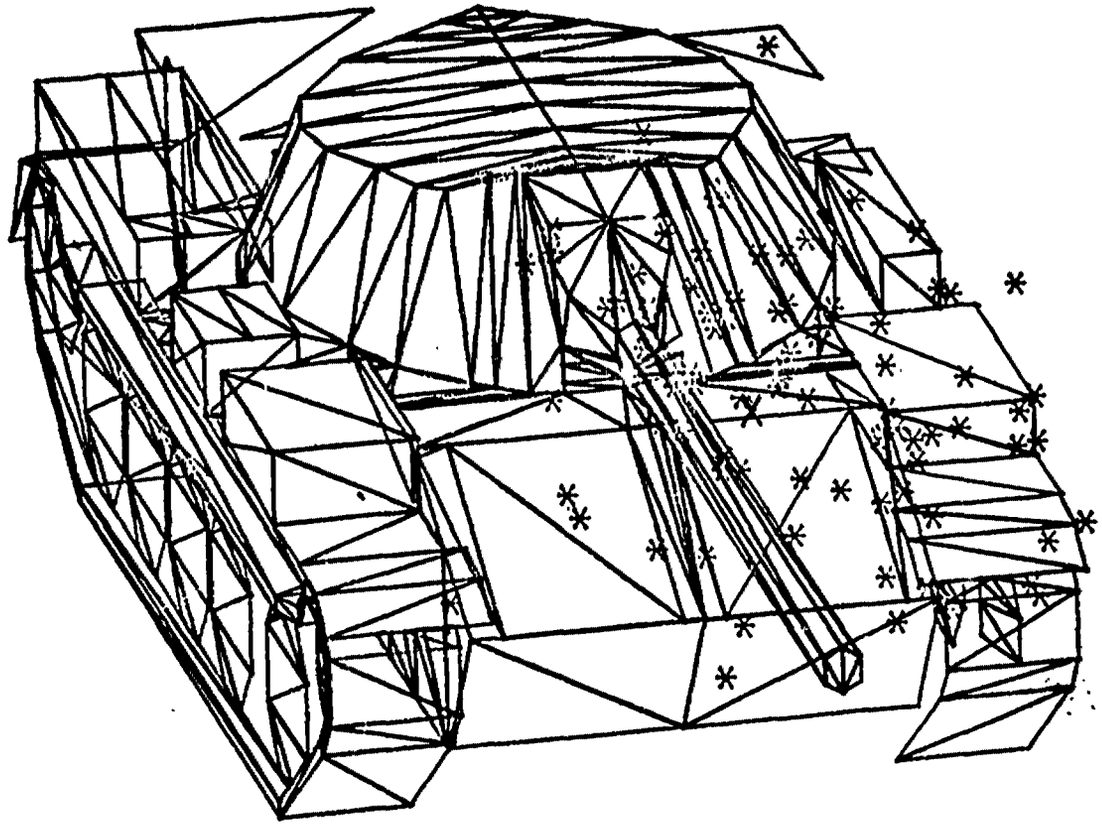
RANK	DEVIATE
0.05	17.36
0.10	19.85
0.15	28.70
0.20	39.02
0.25	49.12
0.30	51.39
0.35	54.29
0.40	57.34
0.45	59.76
0.50	60.36
0.55	62.23
0.60	64.66
0.65	68.49
0.70	71.44
0.75	73.41
0.80	74.61
0.85	79.02
0.90	81.78
0.95	89.23

LOFAC COMPARISON WITH ZOT.14 RUN 493

FACET NO.	NO. OF IMPACTS
182	8
178	5
231	5
136	4
238	4
-286	3
-136	3
134	3
135	3
243	3
286	3
-287	2
-271	2
181	2
183	2
235	2
240	2
242	2
253	2
283	2
-283	
-280	1
-237	1
-231	1
-177	1
65	1
66	1
121	1
137	1
142	1
144	1
187	1
188	1
232	1
234	1
241	1
245	1
246	1
271	1
295	1


LOFRC COMPARISON WITH ZOT.14 RUN 493
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 71.3 PHI =-12.1
SCALE: X = -150 TO 150
Y = -100 TO 100



LOFAC COMPARISON WITH ZOT..14 RUN 493

RP -PHYSICS

HIPAC COMPARISON WITH [illegible] PAGE 1

THERE WERE 6 MISSES

THEY WERE REPS #: 20 33 47 59 75 78

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

81	8.5637	63	45.5687	40	57.6788	29	66.6152	26	74.4808
8	16.4981	17	47.4439	10	59.0009	42	66.9225	2	74.5393
74	17.1330	64	49.4253	67	59.1405	57	67.5882	24	76.2192
49	18.7774	83	50.1078	60	59.2329	41	67.7223	44	77.9674
36	19.5645	45	51.0152	37	59.5057	25	68.3475	18	79.3384
21	19.8707	19	51.4763	4	59.6991	76	68.5205	72	80.4572
71	20.9765	12	51.5493	11	59.7386	7	70.9869	1	81.2522
16	21.0447	82	51.9876	15	59.8269	84	71.1587	13	85.4025
27	23.0136	58	52.2913	46	60.0722	34	72.7580	6	85.7892
65	29.3835	68	53.3489	50	60.3676	54	72.7845	55	94.2510
52	30.0951	61	53.7436	30	60.4968	38	73.2719	39	96.2559
48	32.4685	77	54.9276	51	61.2044	32	73.4572		
31	33.4656	85	55.7169	53	62.5403	28	73.8259		
3	38.4857	70	56.2332	79	62.8477	9	73.8492		
14	39.3788	65	56.5990	73	64.5114	62	74.0084		
35	41.1026	23	56.6877	69	64.6340	43	74.0764		
80	43.9029	56	57.0852	5	65.2164	22	74.4119		

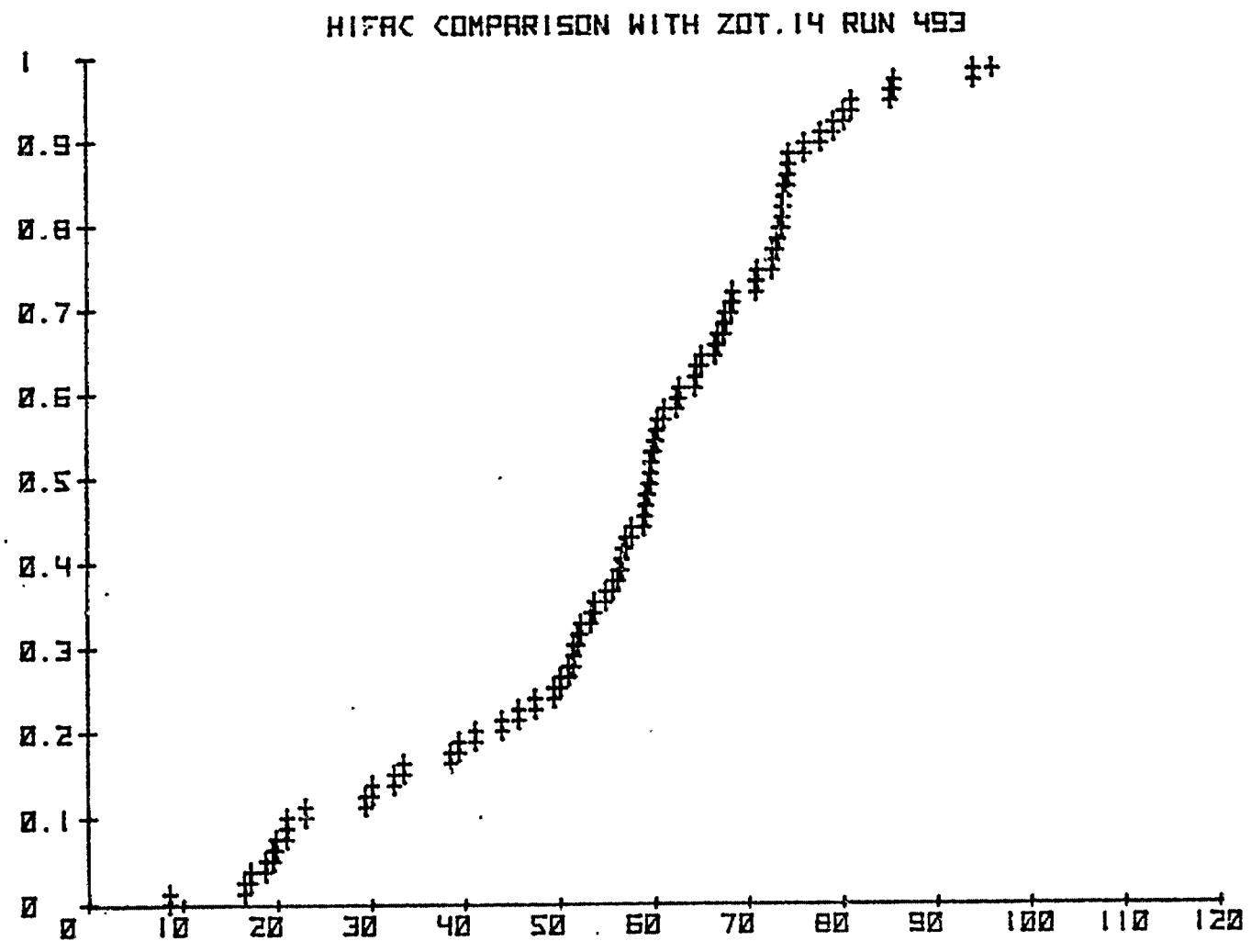
OBLIQUITY MEAN 56.9747 DEG, STANDARD DEVIATION 19.3833 DEG

PERCENTILES:

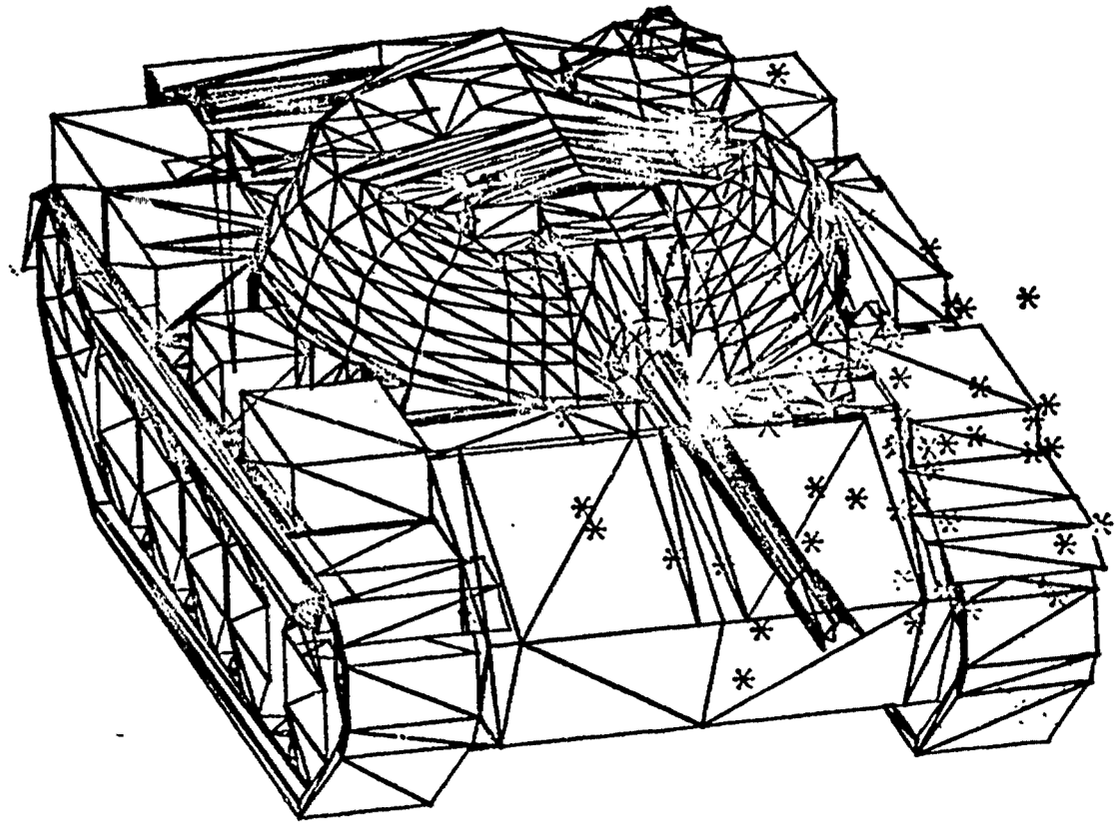
RANK	DEVIATE
0.05	18.78
0.10	21.04
0.15	32.46
0.20	41.10
0.25	49.43
0.30	51.55
0.35	53.74
0.40	56.60
0.45	59.00
0.50	59.70
0.55	60.37
0.60	62.85
0.65	66.62
0.70	68.35
0.75	72.76
0.80	73.83
0.85	74.41
0.90	77.97
0.95	85.40

HIFAC COMPARISON WITH ZAT.14 RUN 493

FACET No.	NO. OF IMPACTS
337	6
365	5
395	5
399	5
172	3
311	3
333	3
387	3
390	3
-119	2
-118	2
118	2
180	2
191	2
343	2
400	2
583	2
-406	1
-308	1
-175	1
-121	1
-101	1
-100	1
-93	1
-89	1
58	1
93	1
100	1
106	1
161	1
164	1
175	1
183	1
183	1
186	1
195	1
254	1
312	1
336	1
358	1
518	1
520	1
522	1
582	1.


HIFAC COMPARISON WITH ZOT.14 RUN 493
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 71.3 PHI =-12.1
SCALE: X = -160 TO 140
Y = -100 TO 100



HIFAC COMPARISON WITH ZOT.14 RUN 493

THERE WERE 0 MISSES

THEY WERE REPS #:

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

11	8.5205	41	43.7437	63	55.9152	56	62.1299	7	71.7068
26	10.2701	75	44.6612	29	56.0038	74	62.8065	69	71.9331
32	16.7112	72	45.7861	78	56.1581	38	63.2504	1	72.5447
45	19.2503	85	46.2344	2	57.4490	46	63.5119	39	72.9483
5	21.4518	58	46.4704	50	57.5614	52	65.2408	42	73.1239
67	27.1221	36	47.9558	23	57.9214	84	65.2779	44	73.2390
48	30.2993	83	48.5381	82	58.6467	13	65.6015	43	74.6820
76	30.3250	51	49.0126	66	59.2258	17	66.1730	70	74.8721
33	32.8411	62	49.8460	18	59.5050	22	67.2798	34	75.3439
40	33.2775	65	51.3875	79	59.6284	80	67.7291	10	76.4423
15	33.7201	77	51.6959	53	59.7367	20	68.5600	24	76.8538
78	36.9557	55	53.1906	12	59.9849	49	68.7295	14	78.5102
35	37.5630	25	53.8255	6	60.2130	37	69.0462	31	79.1399
47	38.4277	60	54.2993	81	60.7867	9	70.4061	71	79.6685
30	39.3174	21	54.6007	19	61.6846	16	70.9518	57	83.7707
59	40.3897	3	54.8930	68	61.7408	9	71.4587	27	84.3315
61	41.1158	54	55.1791	64	61.7429	28	71.5163	4	86.8141

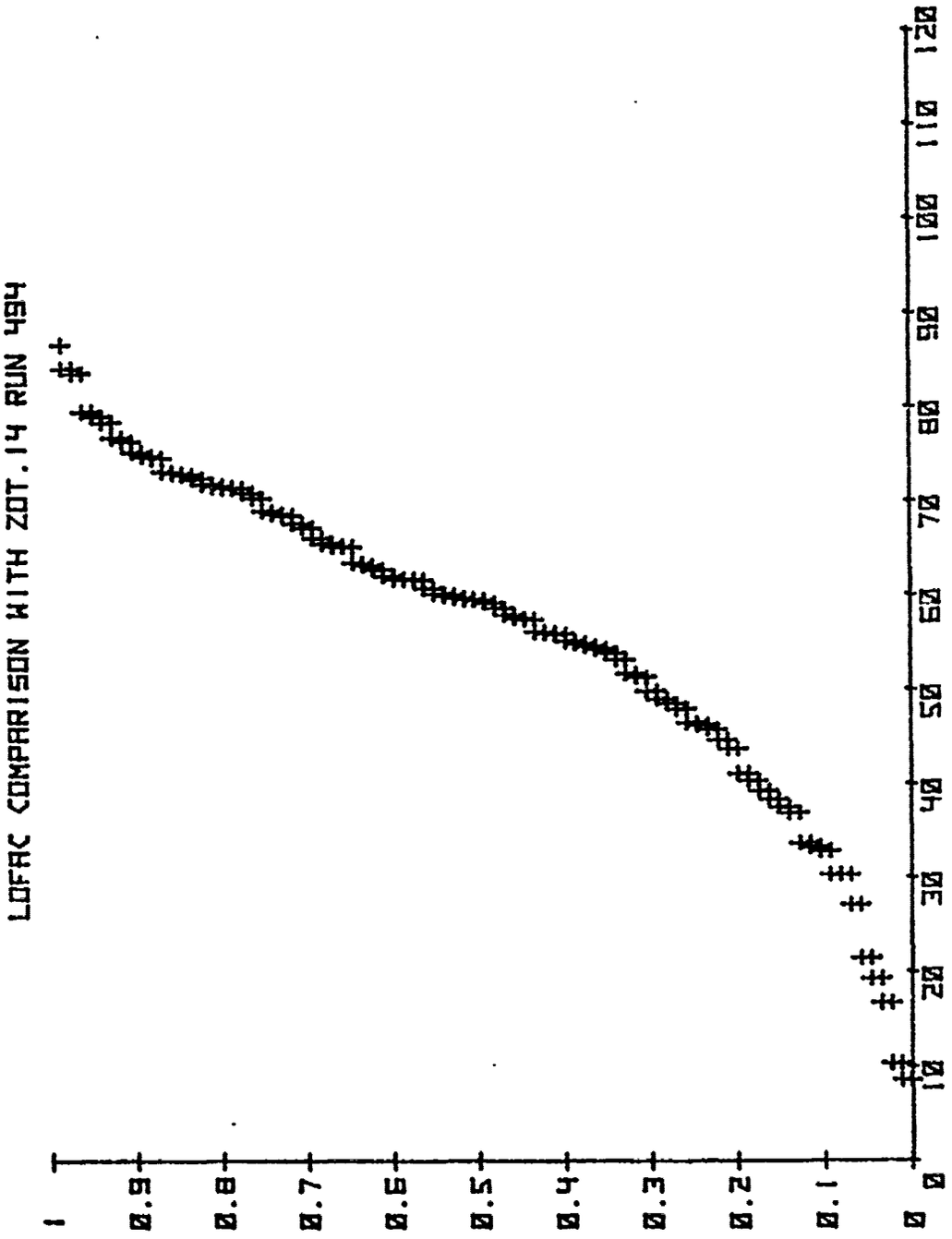
OBLIQUITY MEAN 56.4515 DEG, STANDARD DEVIATION 17.2048 DEG

PERCENTILES:

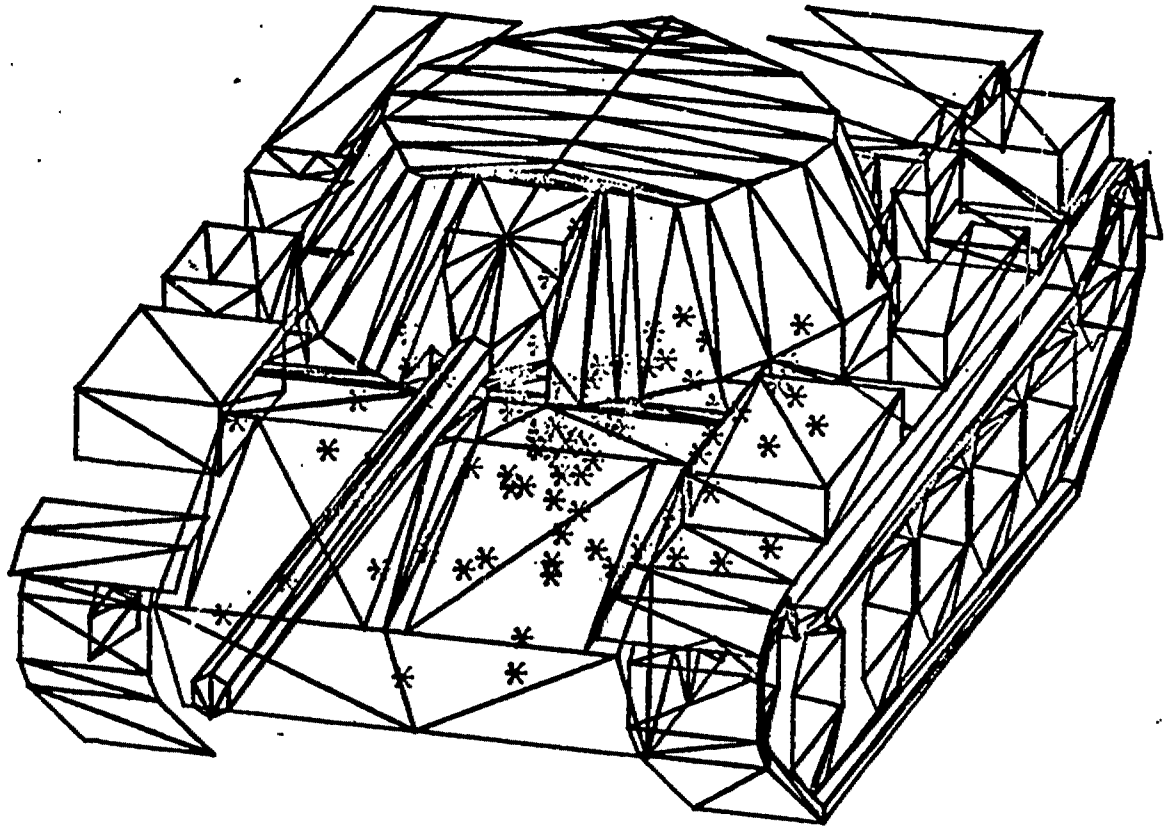
RANK	DEVIATE
0.05	19.91
0.10	31.83
0.15	37.50
0.20	41.64
0.25	46.35
0.30	49.68
0.35	53.87
0.40	55.47
0.45	57.53
0.50	59.51
0.55	60.39
0.60	61.98
0.65	65.07
0.70	67.37
0.75	69.73
0.80	71.67
0.85	73.14
0.90	75.78
0.95	79.51

LOFAC COMPARISON WITH 3OT.14 RUN 494

FACET NO.	NO. OF IMPACTS
136	19
231	9
178	7
242	5
286	5
146	3
-286	2
-136	2
134	2
135	2
137	2
232	2
234	2
238	2
274	2
-292	1
-270	1
-238	1
-231	1
-134	1
171	1
182	1
196	1
235	1
240	1
241	1
246	1
253	1
26[illegible]	1
27[illegible]	1
272	1
278	1
279	1
284	1


LOFRC COMPARISON WITH ZOT.14 RUN 494
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 69.8 PHI = 15.5
SCALE: X = -200 TO 100
Y = -110 TO 90



LOFAC COMPARISON WITH ZOT.14 RUN 494

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 495 PAGE 1

THERE WERE 2 MISSES

THEY WERE REPS #: 60 72

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

12	4.4805	13	38.7106	83	50.4191	27	60.3146	39	73.8742
25	7.6093	15	38.9446	62	50.8728	23	60.4750	69	74.1196
17	12.6332	35	41.3050	59	53.0967	75	60.4939	42	74.2215
26	12.8013	78	41.3804	77	53.4626	74	61.1635	58	75.6803
9	13.2242	11	41.7843	73	53.5388	49	62.0934	84	76.0926
45	14.1556	38	41.9149	50	55.0348	82	62.2886	43	76.5895
14	14.6429	76	42.6050	55	55.3338	6	62.7848	34	77.1403
40	20.4371	56	44.1143	31	55.4325	18	62.9732	3	77.6833
4	22.7470	52	44.1169	54	56.7836	19	65.0362	71	77.8275
67	25.9922	7	44.4859	33	57.1661	22	65.2030	70	78.3403
79	29.6835	85	46.8689	53	57.6191	57	65.3959	20	78.3561
81	31.6601	64	47.0255	68	59.0002	46	66.6317	21	79.8080
5	32.5270	36	47.1458	63	59.3767	37	67.9377	65	80.0153
48	33.6107	47	48.3753	2	59.5536	8	68.4151	66	84.8250
80	35.5277	51	49.0813	41	59.6076	16	69.6671	10	93.2764
61	38.2517	44	49.4216	32	60.0390	28	71.1791		
30	38.6832	29	50.1390	24	60.1753	1	71.2111		

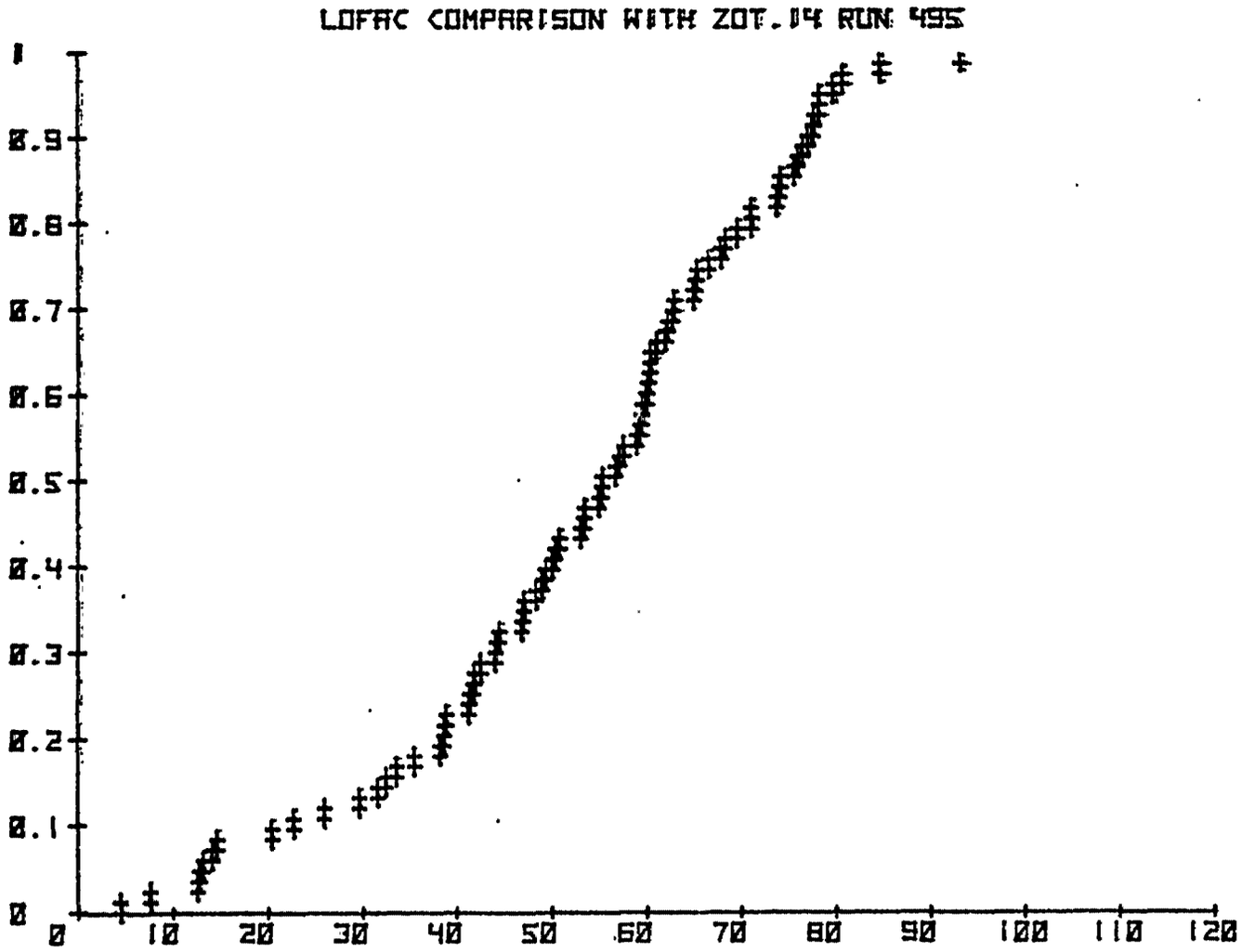
OBLIQUITY MEAN 52.8254 DEG, STANDARD DEVIATION 19.7559 DEG

PERCENTILES:

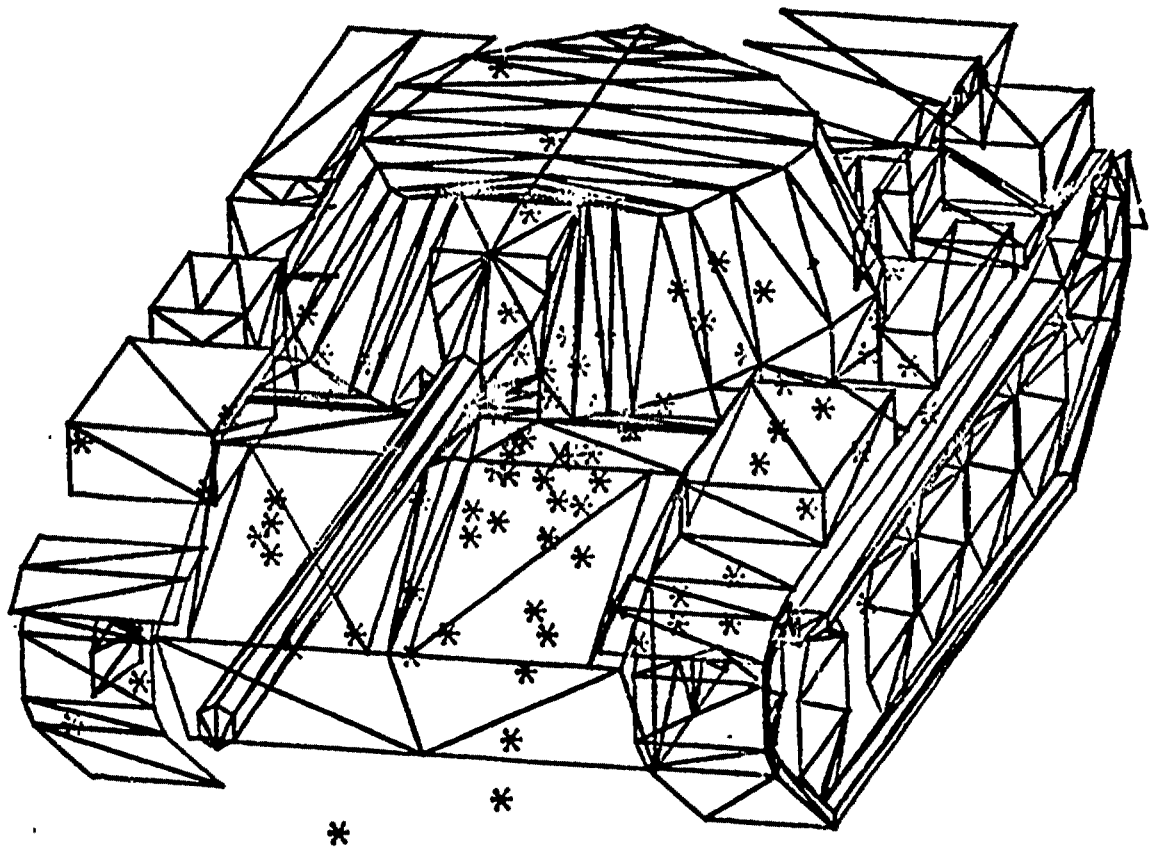
RANK	DEVIATE
0.05	12.89
0.10	21.36
0.15	32.18
0.20	38.60
0.25	41.38
0.30	44.11
0.35	47.07
0.40	49.85
0.45	53.39
0.50	55.43
0.55	59.0C
0.60	60.09
0.65	60.90
0.70	62.94
0.75	66.63
0.80	71.19
0.85	74.81
0.90	77.47
0.95	79.52

LOFAC COMPARISON WITH ZOT.14 RUN 495

FACET NO.	NO. OF IMPACTS
136	14
231	7
-136	5
178	4
134	3
142	3
197	2
238	2
244	2
270	2
284	2
-299	1
-296	1
-278	1
-244	1
-242	1
-240	1
-234	1
-137	1
-67	1
-66	1
48	1
49	1
122	1
137	1
144	1
146	1
150	1
155	1
177	1
179	1
182	1
187	1
196	1
234	1
235	1
239	1
242	1
243	1
245	1
246	1
255	1
274	1
276	1
278	1
283	1
287	1
290	1


LOFAC COMPARISON WITH ZOT.14 RUN 495
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 69.8 PHI = 15.5
SCALE: X = -200 TO 100
Y = -110 TO 90



LOFAC COMPARISON WITH ZOT.14 RUN 495

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 496 PAGE 1

THERE WERE 3 MISSES

THEY WERE REPS #: 20 33 59

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

32	8.5664	43	42.4704	58	50.7623	60	58.9115	34	73.2080
31	12.8124	63	43.3314	23	51.0302	15	59.4521	28	73.9079
48	14.3712	82	43.4462	53	52.0091	69	60.0511	62	73.9294
81	14.6029	54	43.9989	68	52.6739	67	60.4202	38	74.2380
8	14.6216	46	44.8348	5	52.9710	18	60.9473	26	74.4076
74	16.4526	79	45.0366	25	53.3134	41	61.2939	2	74.5745
36	18.9530	17	45.2812	61	53.3860	51	61.8589	39	75.3392
22	20.8745	64	46.2911	77	53.9371	73	64.5792	24	77.0429
11	23.6647	84	46.7324	1	54.0418	12	65.2827	50	79.3892
16	25.5987	70	47.0197	56	54.8976	57	66.2018	72	85.0248
21	26.3392	71	47.7915	65	56.4366	42	67.1586	13	86.3179
47	29.7394	80	49.2745	44	56.9585	76	69.0080	6	86.8382
78	34.5805	27	49.4350	85	57.5179	10	69.7641	29	89.5770
52	37.8896	35	49.6605	30	57.6288	49	71.4083	40	95.6171
3	39.8124	9	49.7960	19	57.6784	7	71.5932		
14	39.9203	83	49.8580	4	58.6364	55	72.5031		
66	42.3017	45	50.3180	37	58.8212	75	72.7736		

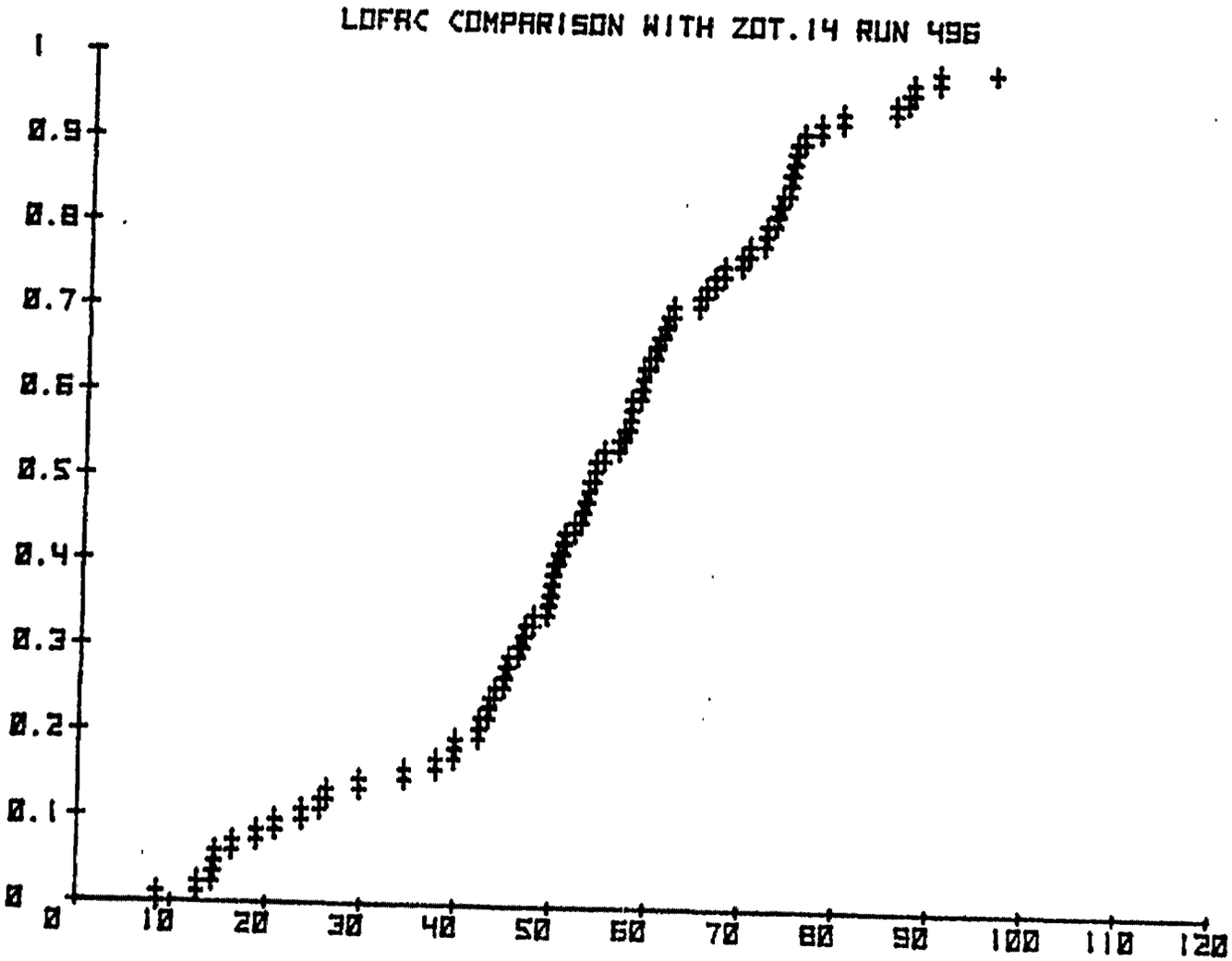
OBLIQUITY MEAN 53.4268 DEG, STANDARD DEVIATION 19.3389 DEG

PERCENTILES:

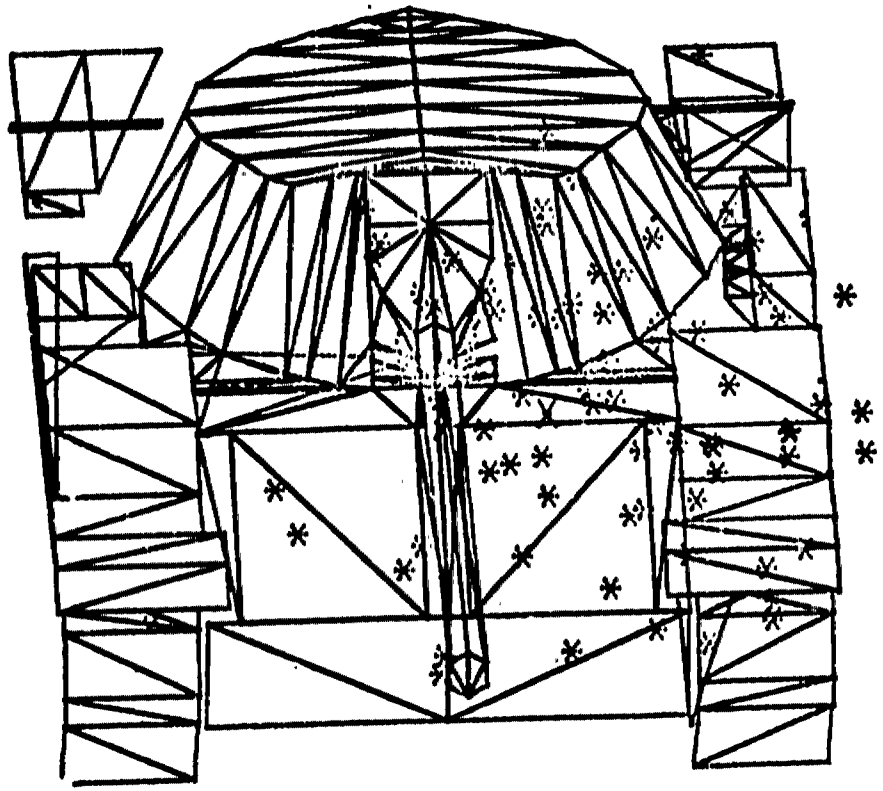
RANK	DEVIATE
0.05	14.61
0.10	21.71
0.15	31.92
0.20	41.35
0.25	43.86
0.30	46.19
0.35	49.28
0.40	49.95
0.45	52.24
0.50	53.66
0.55	56.78
0.60	58.44
0.65	60.02
0.70	62.13
0.75	67.62
0.80	71.96
0.85	73.92
0.90	75.11
0.95	86.12

LOFAC COMPARISON WITH LOT.14 RUN 496

FACET NO.	NO. OF IMPACTS
136	10
182	6
231	5
-136	4
178	3
242	3
-286	2
-271	2
-134	2
134	2
135	2
142	2
187	2
235	2
236	2
238	2
241	2
246	2
270	2
277	2
284	2
-284	1
-283	1
-282	1
-280	1
-270	1
-65	1
65	1
66	1
91	1
144	1
146	1
183	1
188	1
213	1
240	1
243	1
244	1
280	1
283	1
286	1
296	1


LOFRC COMPARISON WITH ZOT.14 RUN 496
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 71.2 PHI = -1.6
SCALE: X = -160 TO 140
Y = -100 TO 100



LOFAC COMPARISON WITH ZOT.14 RUN 496

THERE WERE 0 MISSES

THEY WERE REPS #:

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

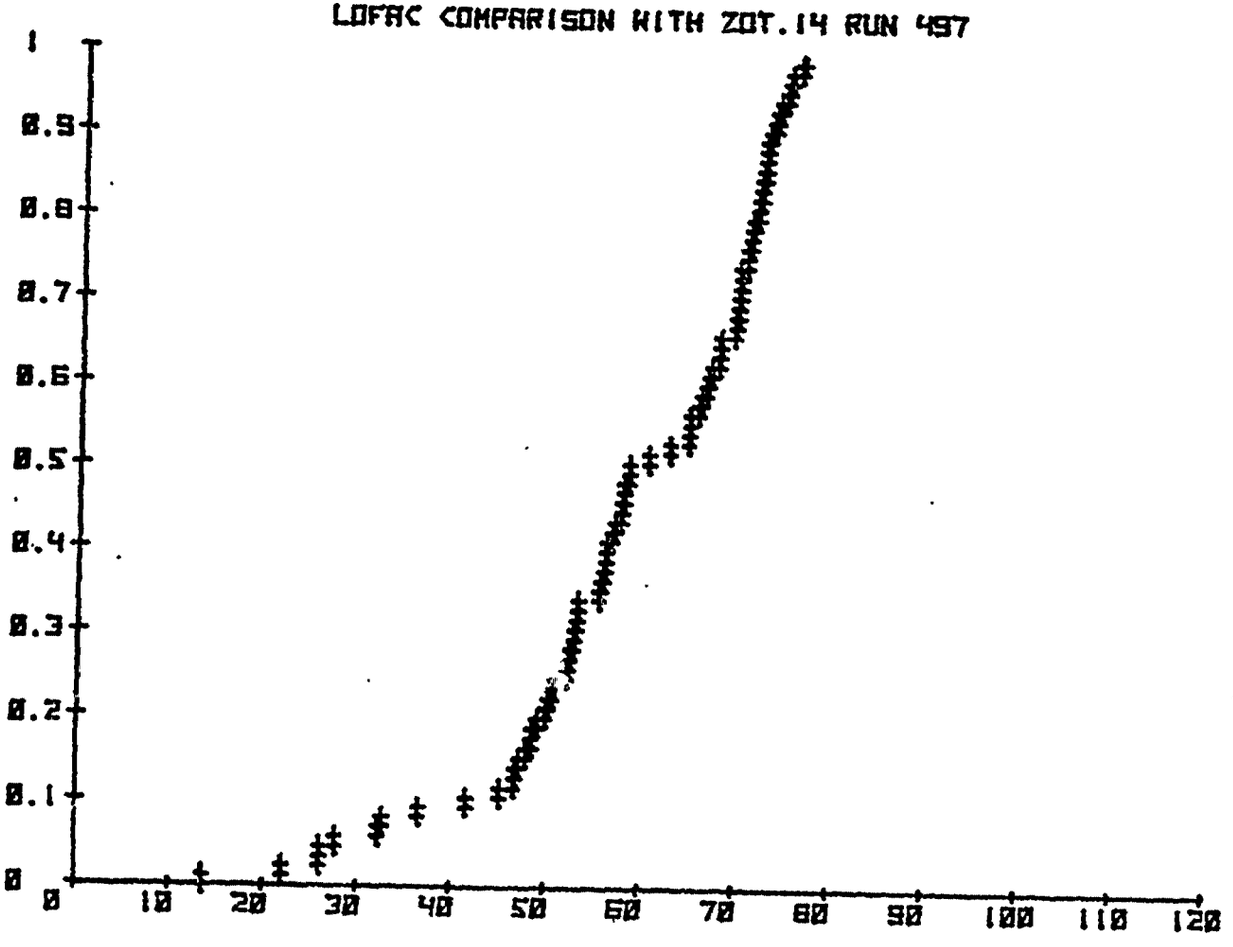
41	13.5797	44	49.9800	12	56.2921	59	66.7811	28	71.8334
76	22.0337	36	50.2668	18	56.7970	78	67.1235	25	71.8807
35	26.0425	77	50.7049	46	57.1325	52	67.8360	42	72.1181
30	26.1048	51	51.0262	19	57.7203	21	67.8921	11	72.1735
48	27.7080	60	52.1437	38	57.8031	67	67.9926	39	72.4394
32	32.2794	82	52.3642	66	57.9761	47	69.4958	8	72.5620
65	32.7006	55	52.4805	49	57.9935	40	69.6203	7	72.5645
27	36.5573	63	52.8728	6	58.4605	17	69.8239	16	72.6915
79	41.6493	54	52.9885	72	58.5177	62	69.8373	9	72.9200
81	45.2395	73	53.2128	13	60.5688	69	69.9875	43	73.4446
61	46.7453	31	53.2865	64	62.8187	22	70.0542	34	73.6934
85	46.8870	14	53.3601	74	64.7582	37	70.0952	1	74.0865
75	47.2157	29	55.5041	45	64.8698	71	70.6826	10	74.6518
83	47.9835	15	55.6678	68	64.8845	53	70.7073	5	74.9443
56	48.5351	2	55.9380	4	65.7918	70	71.0664	24	75.2222
84	48.5475	3	56.1152	33	66.1089	26	71.0782	57	76.2054
58	49.1415	50	56.1867	80	66.5699	20	71.3267	23	76.3879

OBLIQUITY MEAN 58.9332 DEG, STANDARD DEVIATION 13.9352 DEG

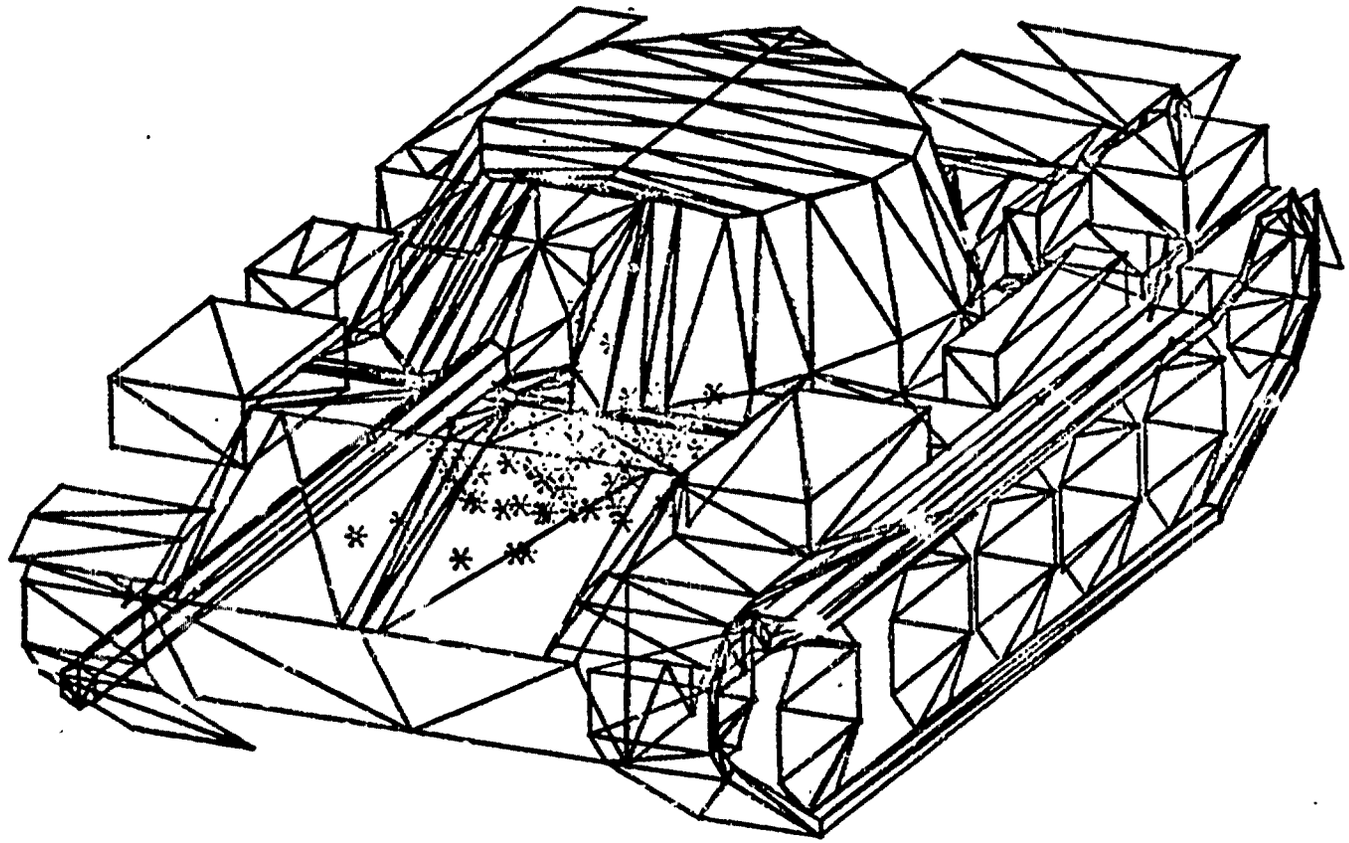
PERCENTILES:

RANK	DEVIATE
0.05	26.59
0.10	39.61
0.15	47.18
0.20	49.31
0.25	51.58
0.30	52.97
0.35	55.52
0.40	56.23
0.45	57.78
0.50	58.52
0.55	64.87
0.60	66.70
0.65	67.98
0.70	69.87
0.75	70.69
0.80	71.73
0.85	72.45
0.90	73.13
0.95	74.86

FACET NO.	NO. OF IMPACTS
231	28
139	27
137	4
232	4
234	3
-232	2
-136	2
240	2
-278	1
-137	1
135	1
171	1
233	1
235	1
238	1
242	1
270	1
275	1
276	1
278	1
286	1


LOFAC COMPARISON WITH ZOT.14 RUN 497
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 69.8 PHI = 25.5
SCALE: X = -200 TO 100
Y = -110 TO 90



LOFAC COMPARISON WITH ZOT.14 RUN 497.

RODMAN LAB-PHYSICS

HIFAC COMPARISON WITH 20T.14 RUN 497 PAGE 1

THERE WERE 0 MISSES

THEY WERE REPS #:

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

48	11.5880	83	47.9835	73	53.2128	4	63.7835	26	71.0782
30	12.3372	56	48.3539	29	55.5041	74	64.7582	20	71.3267
27	12.3602	84	48.3917	15	55.6678	45	64.8698	28	71.3334
53	13.0457	52	48.6919	2	55.9380	68	64.8845	25	71.8807
32	15.4151	58	49.1415	12	56.0900	33	65.1089	42	72.1181
65	17.9683	44	49.7853	3	56.1153	80	66.5699	11	72.1735
76	17.9865	70	49.8400	50	56.1867	59	66.7811	8	72.5620
41	23.1709	36	50.2668	18	56.7970	78	67.1235	7	72.5645
35	26.0425	77	50.7049	46	57.1325	21	67.8921	16	72.6815
39	37.3314	51	51.0262	19	57.7203	67	67.9926	9	72.9208
1	39.4015	60	52.1437	38	57.8031	47	69.4958	13	73.4446
79	41.4618	82	52.3642	66	57.9761	40	69.6203	34	73.6934
81	45.2395	55	52.4805	49	57.9935	17	69.8239	10	74.6518
61	46.7453	54	52.8055	6	58.4605	62	69.8373	5	74.9443
85	46.8870	63	52.8728	72	58.5177	69	69.9875	24	75.2222
37	47.0630	31	53.0917	13	60.5686	22	70.0542	57	76.2954
75	47.2157	14	53.1560	64	62.8187	71	70.6826	23	76.3879

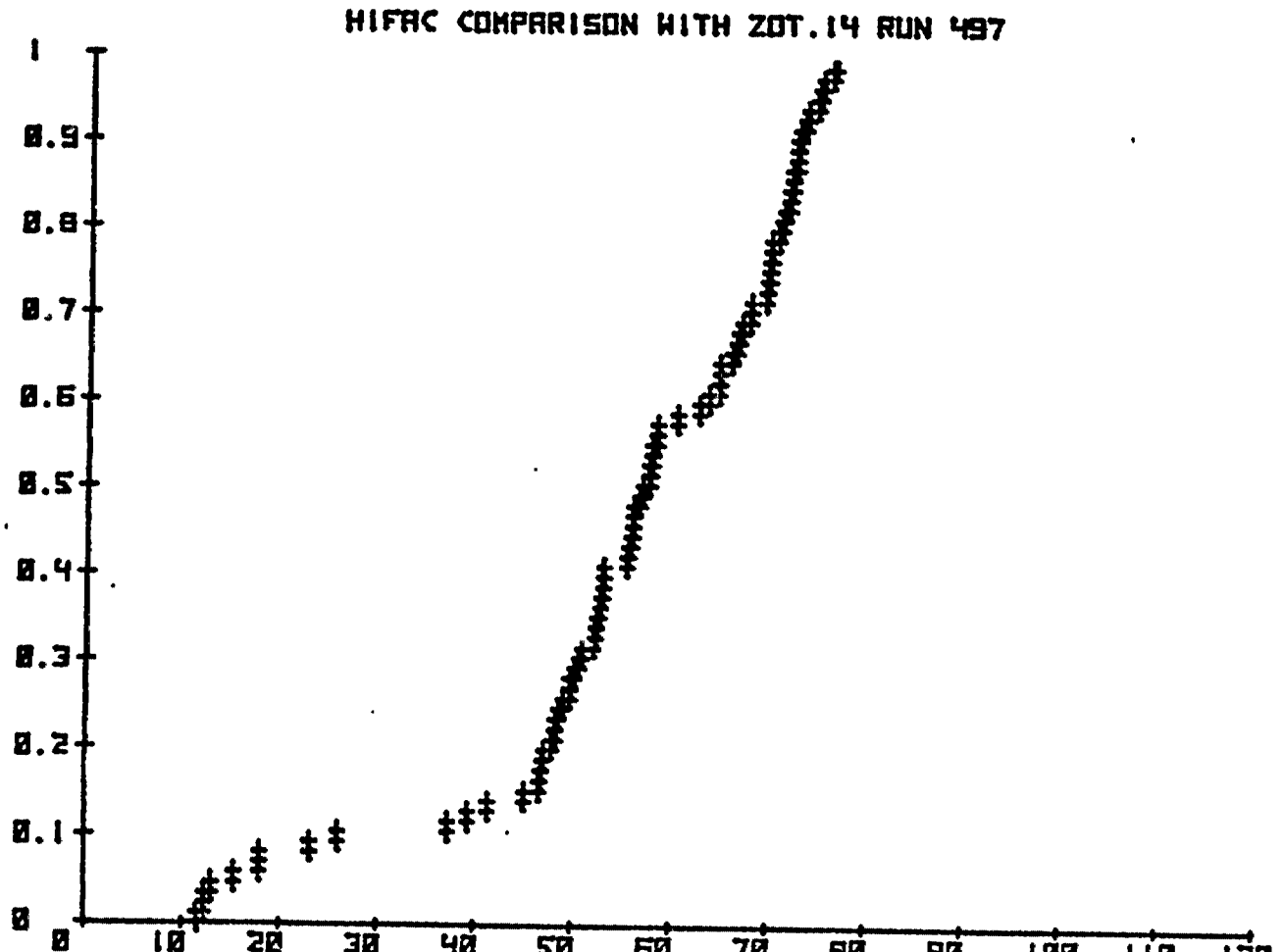
OBLIQUITY MEAN 55.7043 DEG, STANDARD DEVIATION 16.7419 DEG

PERCENTILES:

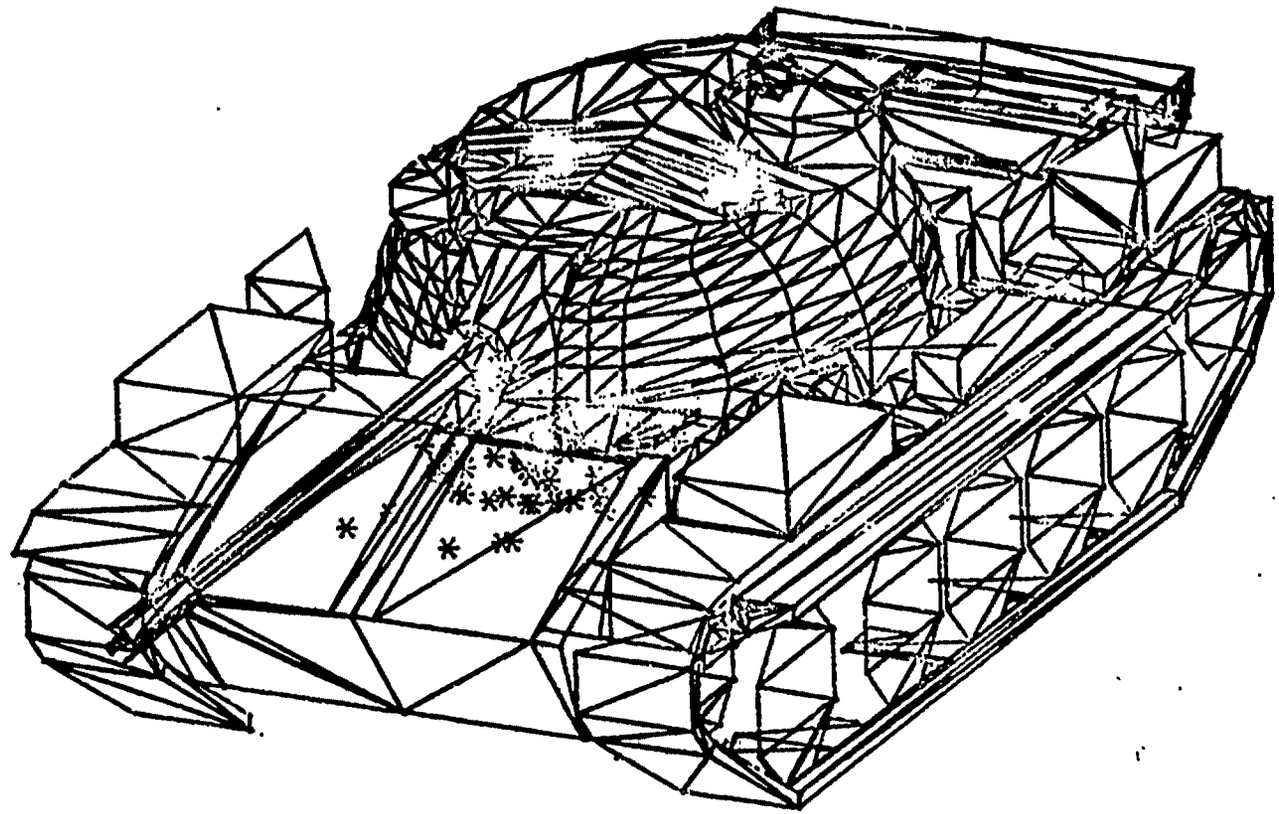
RANK	DEVIATE
0.05	13.76
0.10	24.89
0.15	44.86
0.20	47.37
	48.92
.30	50.62
0.35	52.51
0.40	53.18
0.45	56.04
0.50	57.13
0.55	58.13
0.60	63.40
0.65	65.99
0.70	67.91
0.75	69.83
0.80	71.00
0.85	72.12
0.90	72.78
0.95	74.86

HIFAC COMPARISON WITH ZOT.14 RUN 497

FACET NO.	NO. OF IMPACTS
399	27
256	8
305	5
254	4
255	4
317	4
400	4
-306	2
179	2
253	2
263	2
264	2
306	2
307	2
389	2
-390	1
98	1
111	1
119	1
162	1
164	1
171	1
173	1
180	1
257	1
284	1
311	1
395	1


HIFAC COMPARISON WITH ZOT.14 RUN 497
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 69.8 PHI = 25.9
SCALE: X = -250 TO 50
Y = -100 TO 100



HIFRC COMPARISON WITH ZOT.14 RUN 497

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 498 PAGE 1

THERE WERE 0 MISSES

THEY WERE REPS #:

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

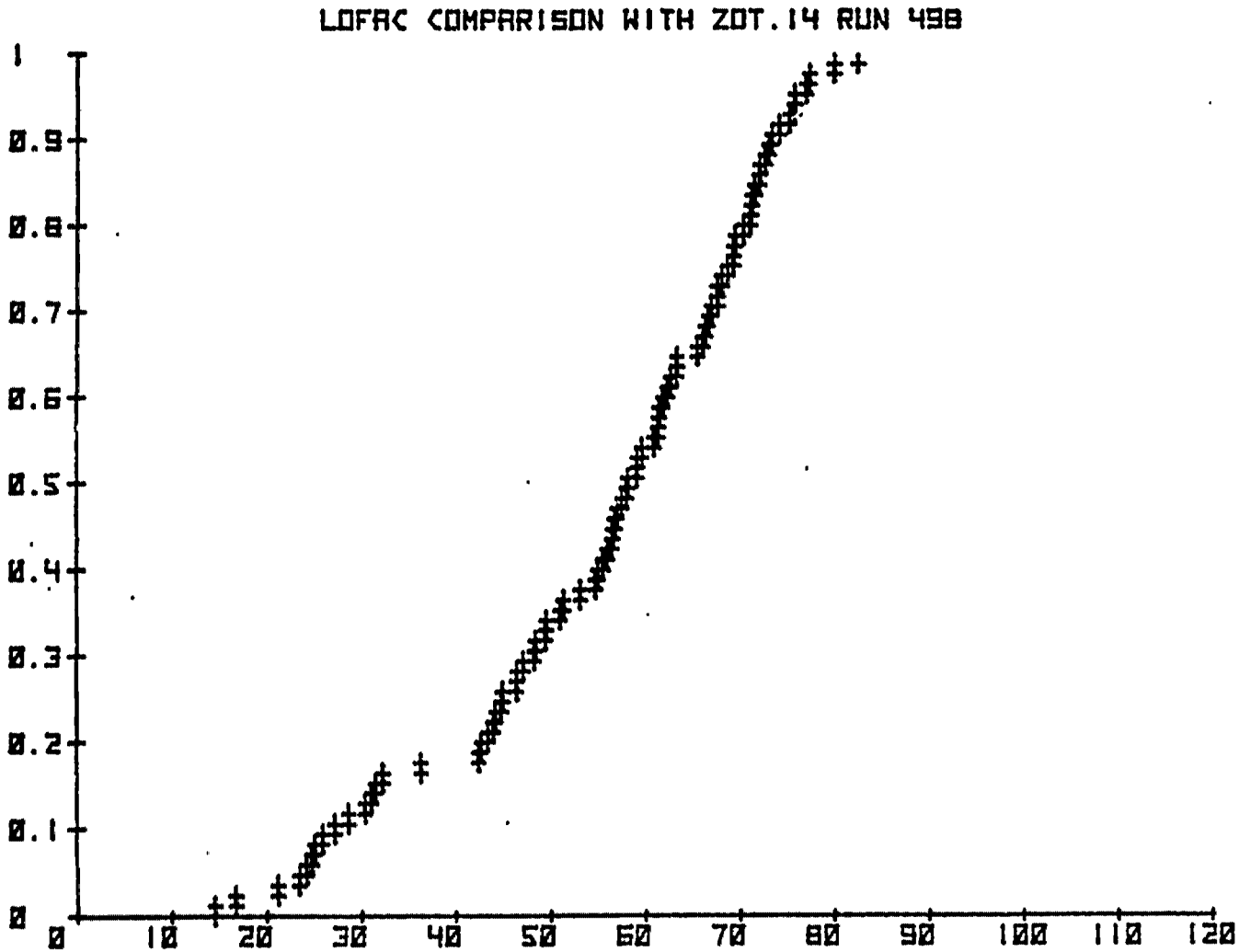
45	14.5968	41	43.4223	60	55.5704	74	62.4062	28	71.1971
11	16.7741	61	43.9735	32	56.0084	80	62.7321	7	71.2620
27	21.2047	65	44.2080	63	56.4564	38	63.4062	9	71.3554
76	23.4712	25	44.7807	3	56.5708	46	63.4141	16	71.6493
67	24.2057	64	44.9195	73	56.8259	13	65.5956	69	72.1297
4	24.7833	72	46.4040	2	57.0403	17	66.1050	40	72.2215
33	25.1063	75	46.4914	29	57.5527	52	66.3707	1	72.7962
48	25.9398	85	47.1772	82	58.0326	84	66.6722	42	73.1957
35	27.2192	36	48.2981	53	58.2084	22	67.0244	39	73.5350
30	28.6771	58	48.4461	23	59.1407	56	67.6603	70	74.2646
78	30.4299	83	49.4759	12	59.2046	54	67.6831	10	75.3566
5	31.1062	66	49.6099	18	59.6787	71	68.1457	34	75.8522
59	31.5430	62	51.0464	50	60.9559	37	68.7235	43	75.9473
47	32.3328	51	51.4141	6	61.3942	20	69.3345	31	77.1067
79	36.3302	14	53.1577	81	61.4348	26	69.3863	24	77.4819
15	42.4701	55	54.7426	19	61.5353	49	69.5855	44	80.1296
21	42.7282	77	55.0414	68	61.9249	8	70.4717	57	82.6520

OBLIQUITY MEAN 55.3167 DEG, STANDARD DEVIATION 16.7618 DEG

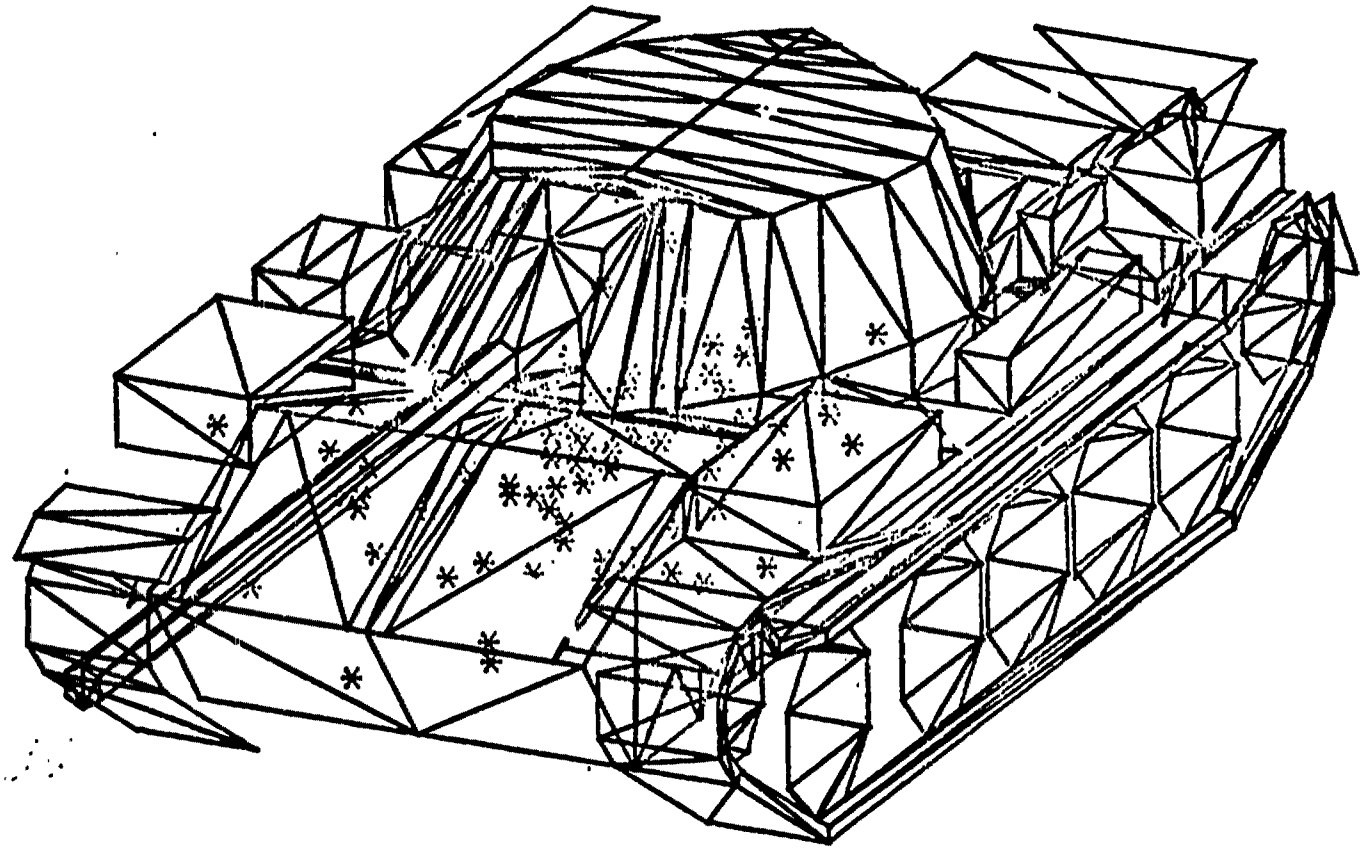
PERCENTILES:

RANK	DEVIATE
0.05	23.69
0.10	26.71
0.15	31.50
0.20	42.87
0.25	44.85
0.30	48.07
0.35	51.08
0.40	55.25
0.45	56.75
0.50	58.21
0.55	61.09
0.60	62.21
0.65	65.38
0.70	67.15
0.75	69.03
0.80	71.05
0.85	72.14
0.90	73.83
0.95	76.76

FACET NO.	NO. OF IMPACTS
136	18
231	10
178	6
242	6
-136	4
146	3
232	3
286	3
237	3
-240	2
-137	2
135	2
238	2
-278	1
-231	1
-134	1
134	1
137	1
171	1
182	1
197	1
233	1
234	1
235	1
239	1
240	1
246	1
253	1
270	1
274	1
275	1
284	1
285	1
292	1


LOFRC COMPARISON WITH ZOT.14 RUN 498
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 69.8 PHI = 25.5
SCALE: X = -200 TO 100
Y = -110 TO 90



LOFRC COMPARISON WITH ZOT.14 RUN 498

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 499 PAGE 1

THERE WERE 4 MISSES

THEY WERE REPS #: 4 54 60 72

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

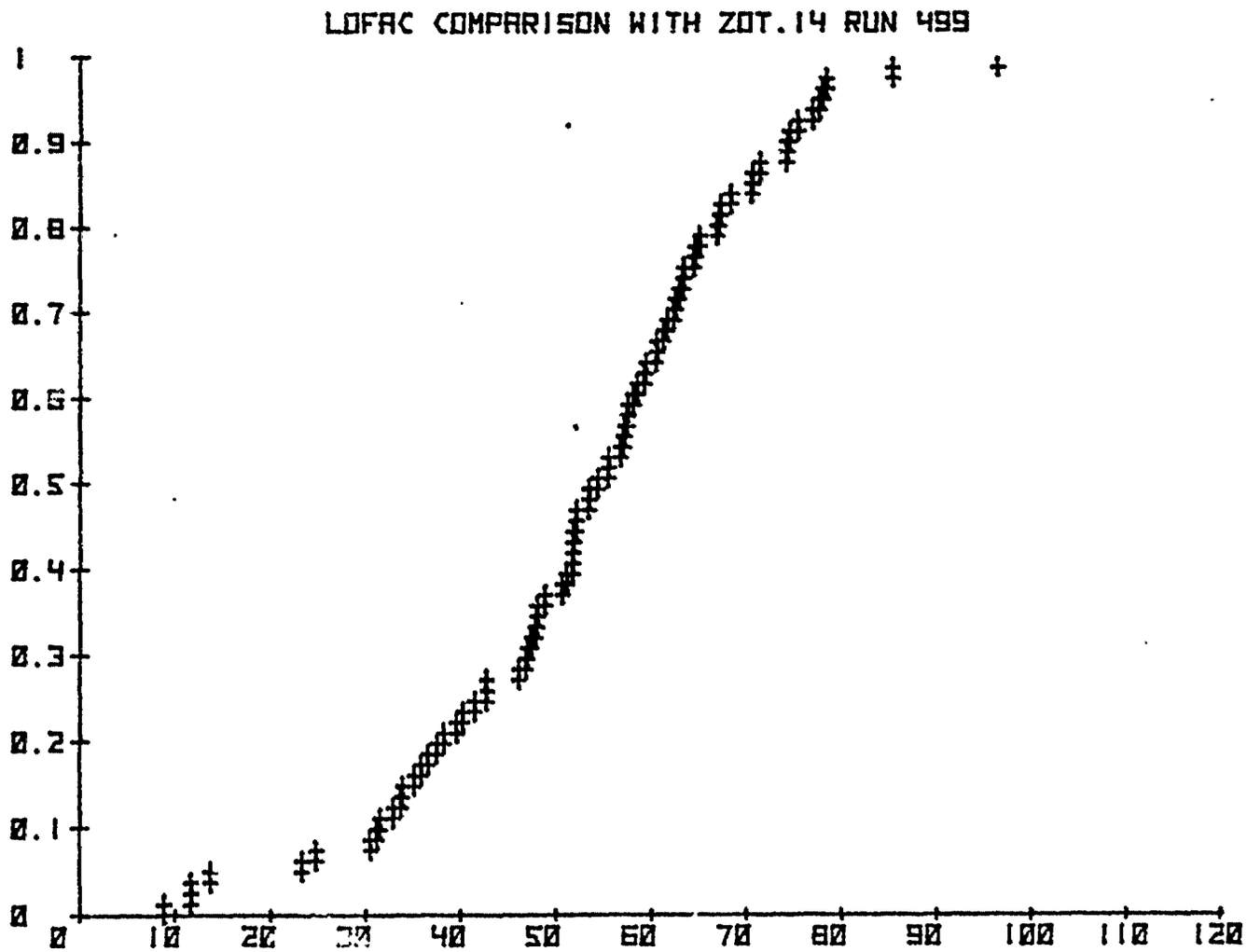
12	8.8222	13	39.5972	51	51.8296	63	59.5200	16	70.6995
25	11.6407	47	40.2936	62	51.8782	74	60.5311	28	70.7647
40	11.6501	61	41.4738	52	52.1847	75	60.6928	1	71.5780
45	13.7028	38	42.7672	49	52.1944	32	61.3921	42	74.0143
9	23.2771	59	42.7898	80	53.4800	23	61.7339	69	74.3914
67	24.7683	56	46.1100	64	53.5877	82	62.4345	39	74.6736
79	30.4665	36	46.8636	73	54.4621	17	62.8497	10	75.5618
48	31.1745	15	47.0358	31	55.5089	18	62.9957	71	77.0830
11	31.5107	85	47.4554	5	55.6105	65	63.4009	70	77.8021
76	32.9385	58	47.8672	55	56.8041	6	63.5382	20	78.1363
26	33.7263	33	48.0338	53	57.0957	22	64.5889	43	78.5256
35	33.9160	50	48.0792	77	57.2435	19	64.7231	66	85.5083
78	35.1684	44	48.8905	27	57.4975	57	65.1921	41	96.5857
34	35.8671	84	5?.6899	14	57.6155	46	66.9977		
81	36.5864	83	51.1793	21	58.1257	3	67.2027		
7	37.4766	24	51.7783	2	58.5762	37	67.4218		
30	38.2596	29	51.8232	68	59.2966	8	68.4751		

OBLIQUITY MEAN 53.0346 DEG, STANDARD DEVIATION 17.3345 DEG

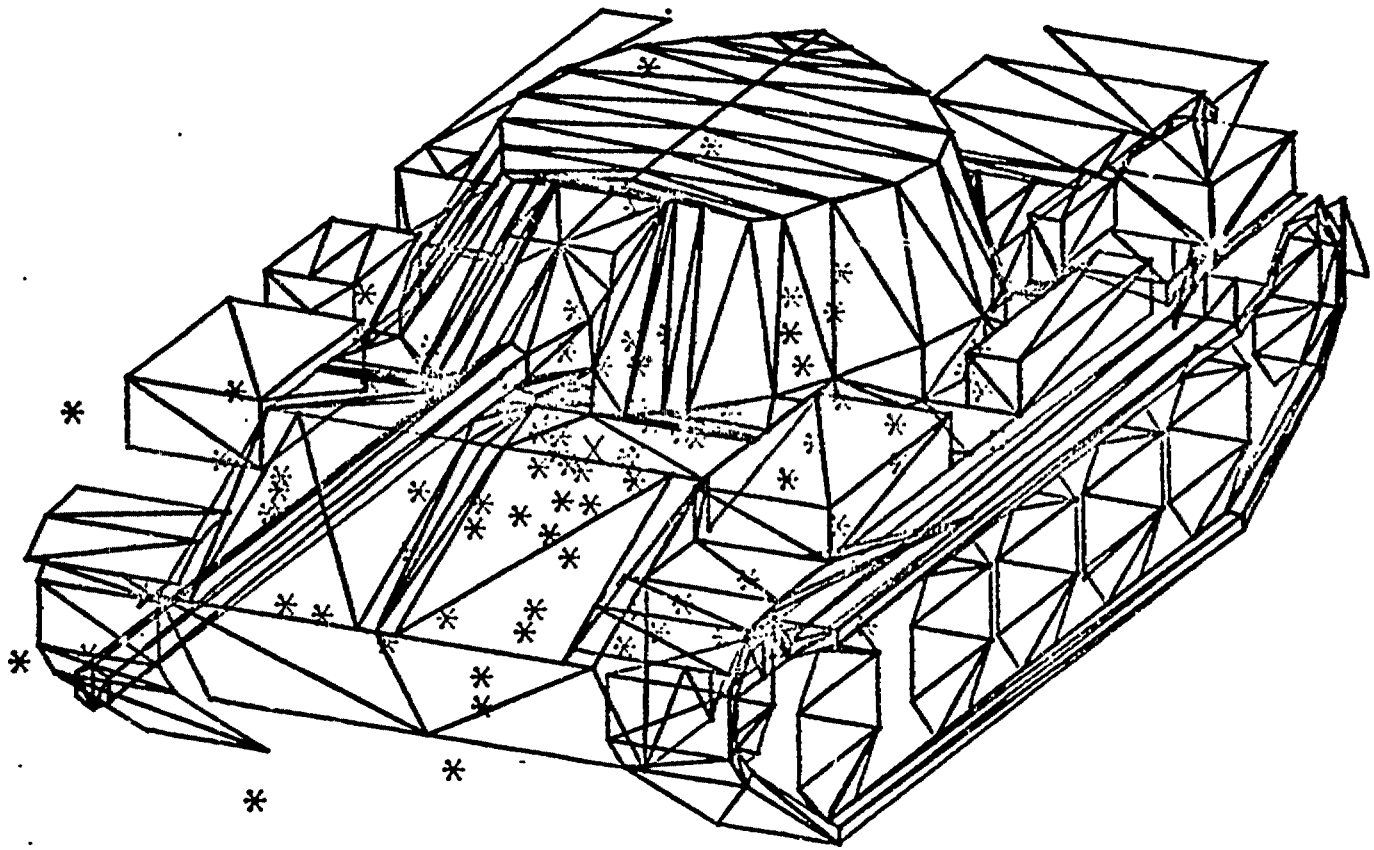
PERCENTILES:

RANK	DEVIATE
0.05	14.66
0.10	31.24
0.15	34.29
0.20	37.79
0.25	42.12
0.30	46.97
0.35	48.07
0.40	51.66
0.45	52.15
0.50	54.46
0.55	57.11
0.60	58.22
0.65	60.58
0.70	62.52
0.75	64.06
0.80	67.15
0.85	70.75
0.90	74.62
0.95	78.10

FACET NO.	NO. OF IMPACTS
136	14
-136	7
231	6
178	4
244	4
134	3
238	3
142	2
177	2
179	2
187	2
245	2
270	2
277	2
-299	1
-242	1
-235	1
-232	1
-231	1
-202	1
-137	1
-67	1
28	1
30	1
50	1
144	1
145	1
168	1
183	1
193	1
197	1
232	1
234	1
235	1
278	1
283	1
284	1
287	1
290	1
296	1


LOFAC COMPARISON WITH ZOT.14 RUN 499
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 69.8 PHI = 25.5
SCALE: X = -200 TO 100
Y = -110 TO 90



LOFAC COMPARISON WITH ZOT.14 RUN 499

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 500 PAGE 1

THERE WERE 10 MISSES

THEY WERE REPS #: 4 10 14 38 41 53 54 60 72 73

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

45	13.5746	47	45.4366	74	59.5137	19	67.2268	43	80.6175
68	16.1408	36	45.7952	21	59.9418	51	67.9602	70	80.8627
29	18.4185	64	46.1728	2	60.1216	3	68.0837	24	82.1155
35	21.1221	40	48.3795	75	60.3729	32	68.5712	65	84.8815
67	28.5586	59	49.1990	11	61.6724	17	69.8131	12	87.8875
26	36.4017	84	49.7028	85	61.7575	58	69.9087	66	96.1824
48	37.3922	5	51.4811	63	62.2222	16	69.9457	80	96.3991
13	37.5309	49	51.7156	81	62.2444	1	70.1869		
76	38.3471	7	52.2466	50	62.8831	25	70.6533		
61	39.4207	83	52.7987	22	63.4529	28	70.8441		
46	40.2558	62	53.0822	23	63.4768	15	72.5711		
33	43.1349	78	53.5111	52	63.6316	42	75.4747		
69	44.0694	34	56.2216	6	64.7658	9	75.9858		
79	44.1333	20	57.4071	44	65.4359	39	76.2267		
82	44.3513	27	57.4829	37	66.0796	31	79.1409		
30	44.3763	55	58.7209	57	66.5116	18	80.3382		
56	44.7854	77	58.8842	8	66.5587	71	80.5289		

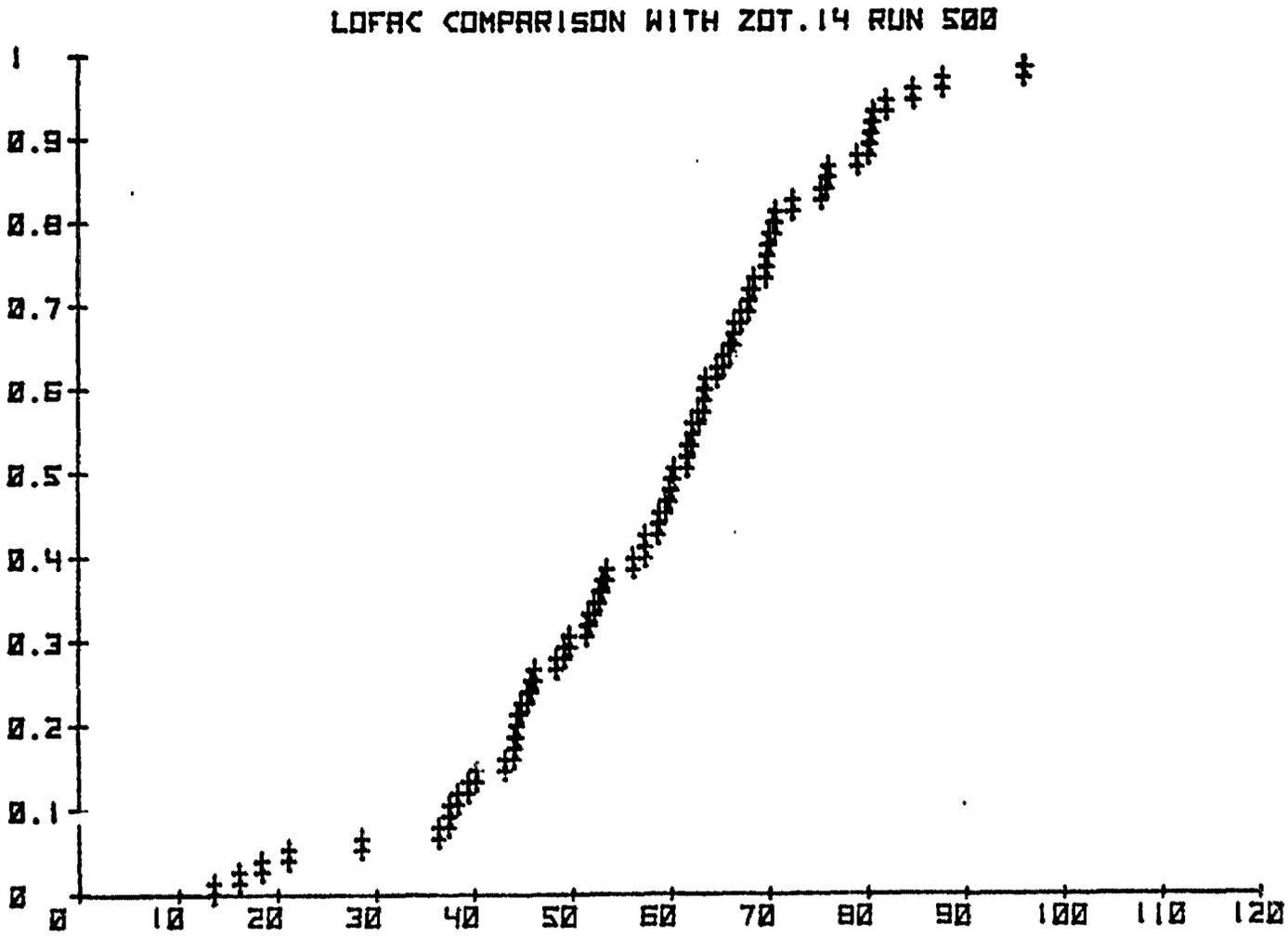
OBLIQUITY MEAN 58.5773 DEG, STANDARD DEVIATION 17.4275 DEG

PERCENTILES:

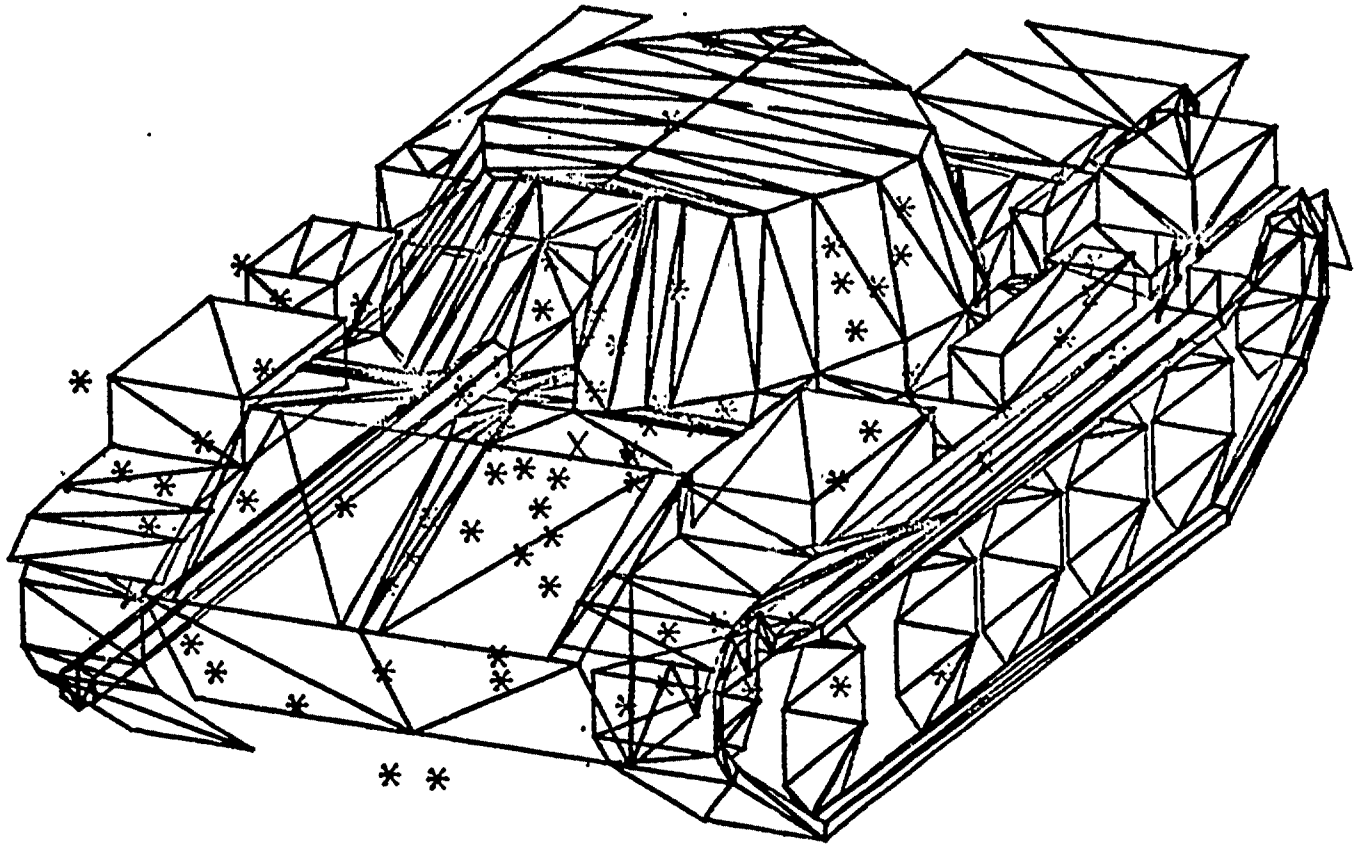
RANK	DEVIATE
0.05	20.58
0.10	37.48
0.15	41.41
0.20	44.36
0.25	45.80
0.30	49.60
0.35	52.58
0.40	56.70
0.45	59.01
0.50	60.37
0.55	62.24
0.60	63.57
0.65	66.25
0.70	67.98
0.75	69.91
0.80	70.81
0.85	76.13
0.90	80.56
0.95	85.48

LOFAC COMPARISON WITH ZOT.14 RUN 500

FACET NO.	NO. OF IMPACTS
136	9
-134	3
134	3
137	3
231	3
246	3
287	3
-146	2
45	2
178	2
184	2
232	2
249	2
270	2
275	2
-300	1
-297	1
-232	1
-202	1
-144	1
-136	1
44	1
48	1
66	1
94	1
111	1
120	1
129	1
142	1
144	1
156	1
177	1
193	1
197	1
203	1
213	1
234	1
235	1
247	1
248	1
249	1
254	1
272	1
279	1
283	1
285	1
286	1


LOFAC COMPARISON WITH ZOT.14 RUN 500
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 69.8 PHI = 25.5
SCALE: X = -200 TO 100
Y = -110 TO 90



LOFRC COMPARISON WITH ZOT.14 RUN 500

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 501 PAGE 1

THERE WERE 0 MISSES

THEY WERE REPS #:

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

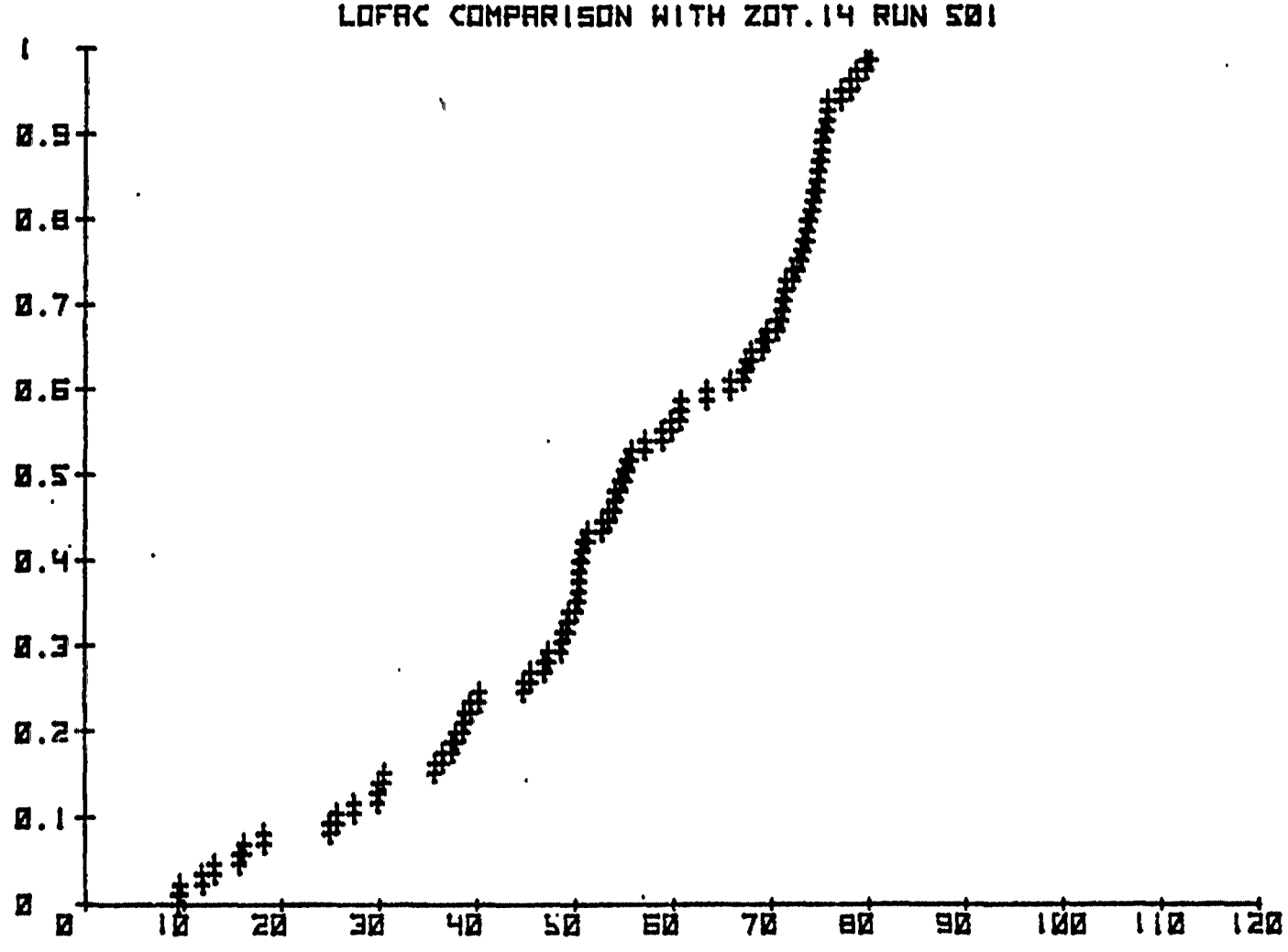
35	9.4148	46	38.5851	49	50.6778	40	65.7941	26	74.0460
72	9.6473	41	38.7422	12	50.8198	52	67.0936	44	74.2313
10	11.9108	34	39.3456	58	51.2921	30	67.3923	9	74.3037
48	13.1484	69	40.2640	81	52.7628	47	67.9168	7	74.6968
66	15.6927	80	44.7417	79	53.3995	59	69.0312	50	74.7463
32	16.1738	71	45.4615	21	53.9565	11	69.5542	31	74.8482
43	18.1917	64	46.8402	22	54.0393	42	70.5561	39	75.1080
82	24.8952	77	47.2633	51	54.5585	62	71.0625	24	75.1892
53	25.6604	84	48.5989	4	55.0175	33	71.1824	37	75.2354
27	27.4151	74	48.6996	1	55.2921	55	71.4076	73	75.6040
57	29.8243	68	49.2356	15	55.7108	85	71.5022	8	75.7251
65	29.9799	56	49.3297	60	57.1007	25	72.1910	2	75.7407
63	30.5026	75	50.0394	3	58.7950	18	72.6546	20	77.1197
70	35.6688	61	50.2784	29	59.7357	5	73.0612	19	78.1224
83	36.5056	45	50.3336	14	60.6635	38	73.2883	13	78.7602
23	37.4291	17	50.3920	67	60.7836	16	73.6900	6	79.7342
76	37.8773	36	50.4335	78	63.3934	28	73.6952	54	80.2079

OBLIQUITY MEAN 54.6002 DEG, STANDARD DEVIATION 19.3759 DEG

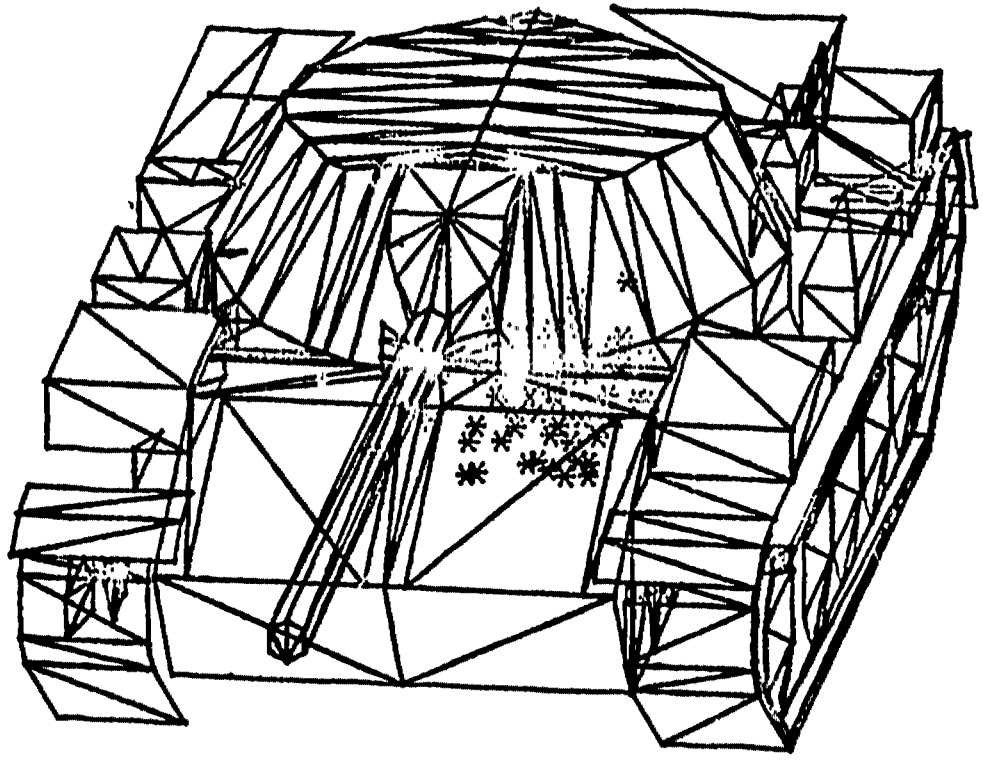
PERCENTILES:

RANK	DEVIATE
0.05	13.91
0.10	25.35
0.15	30.45
0.20	38.02
0.25	42.50
0.30	48.33
0.35	50.06
0.40	50.53
0.45	53.21
0.50	55.02
0.55	59.08
0.60	64.83
0.65	68.92
0.70	71.23
0.75	72.86
0.80	73.98
0.85	74.76
0.90	75.38
0.95	77.82

FACST NO.	NO. OF IMPACTS
231	25
136	23
238	5
240	5
234	3
235	3
242	3
274	3
137	2
232	2
233	2
270	2
277	2
278	2
241	1
284	1
286	1


LOFAC COMPARISON WITH ZOT.14 RUN 501
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 71.1 PHI = 8.9
SCALE: X = -180 TO 120
Y = -100 TO 100



LOFAC COMPARISON WITH ZOT.14 RUN 501

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 502 PAGE 1

THERE WERE 0 MISSES

THEY WERE REPS #:

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

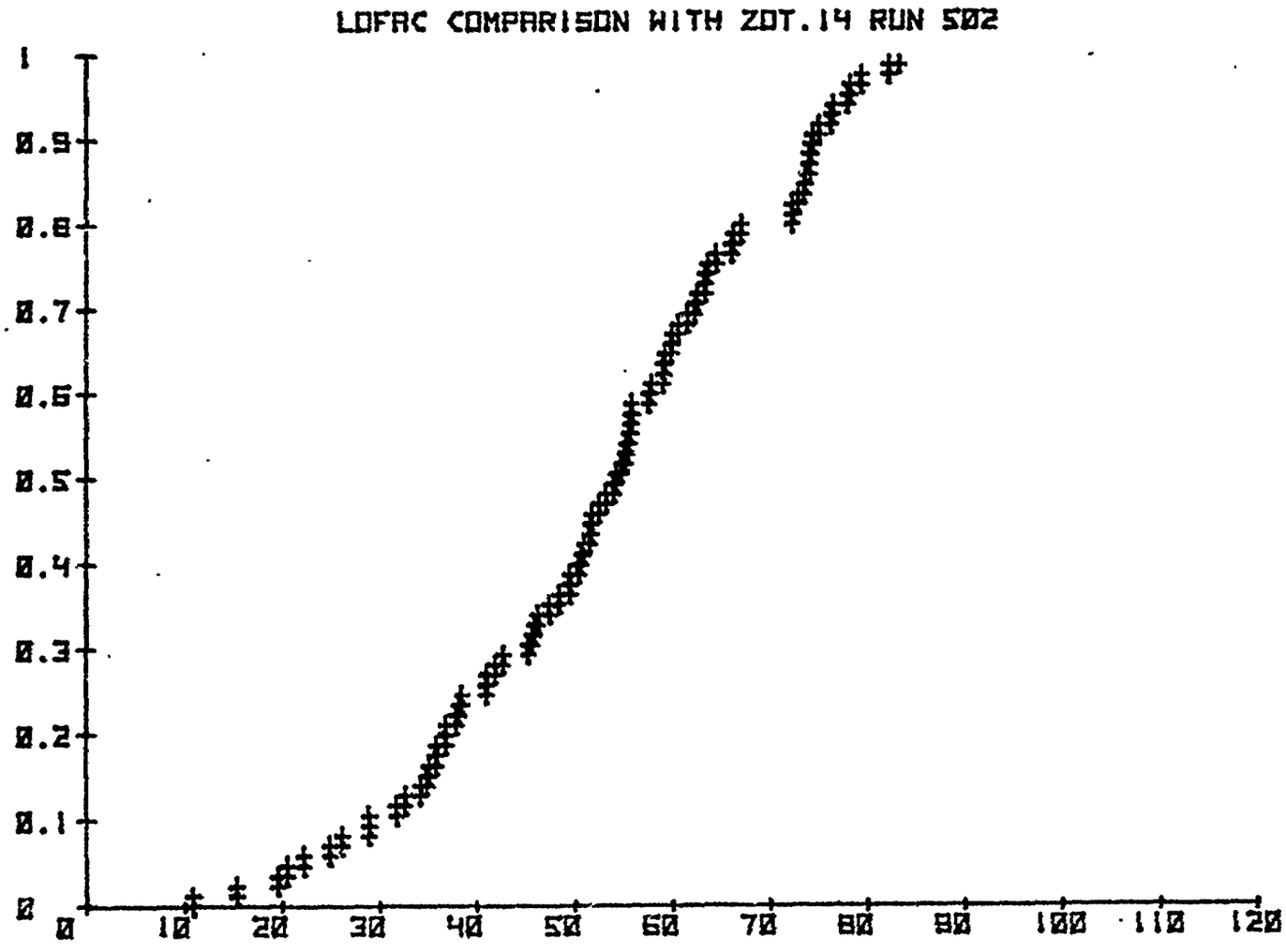
18	10.8303	32	36.8490	68	50.6719	15	57.8326	62	72.3500
80	15.3661	48	37.8896	56	50.9613	79	58.5994	55	72.3809
39	19.5641	69	38.2010	84	51.5360	51	59.0316	9	72.9834
36	20.4903	63	38.5116	81	51.6843	59	59.2631	7	73.5957
74	22.2344	83	40.9879	61	51.7184	78	59.8826	28	73.7652
11	24.9096	57	41.0484	12	52.4979	49	59.9734	38	74.1172
67	26.1557	46	41.8667	16	53.1740	73	60.5771	26	74.1822
33	28.9448	19	42.7187	58	53.9503	30	61.5660	72	74.3115
82	28.9454	49	45.2605	8	54.2076	66	62.2364	75	74.5093
43	31.7553	64	45.6711	85	54.7889	35	62.5988	2	75.1525
21	32.6984	65	45.8767	22	55.1785	52	63.3932	24	76.3621
27	34.2590	71	46.2629	1	55.3558	54	63.4005	31	76.5708
25	34.8770	17	47.4037	44	55.5898	60	63.6414	3	78.0775
23	35.1415	34	48.4220	70	55.7090	47	64.5200	50	78.3309
53	35.8544	77	49.5089	37	55.7567	14	66.0864	20	79.5522
42	35.8618	76	49.5289	4	55.8114	29	66.3329	13	82.3736
41	36.8312	45	50.4070	10	57.6136	5	67.1101	6	83.4567

OBLIQUITY MEAN 52.7754 DEG, STANDARD DEVIATION 16.9825 DEG

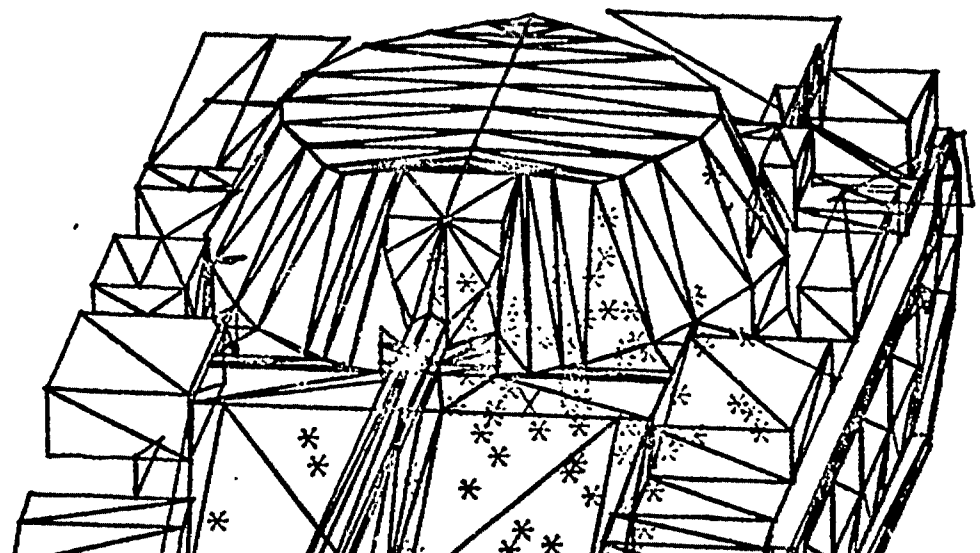
PERCENTILES:

RANK	DEVIATE
0.05	21.01
0.10	28.95
0.15	34.82
0.20	36.83
0.25	39.75
0.30	44.75
0.35	47.51
0.40	50.51
0.45	51.71
0.50	54.21
0.55	55.63
0.60	57.75
0.65	59.82
0.70	62.31
0.75	64.08
0.80	71.30
0.85	73.80
0.90	74.77
0.95	78.29

PALET NO.	NO. OF IMPACTS
136	14
231	9
242	6
135	5
178	4
182	4
-135	3
240	3
270	3
137	2
142	2
235	2
238	2
246	2
250	2
277	2
278	2
281	2
286	2
-280	1
-283	1
-137	1
144	1
146	1
232	1
234	1
241	1
247	1
248	1
271	1
276	1
283	1
284	1


LOFRC COMPARISON WITH ZOT.14 RUN 502
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 71.1 PHI = 8.9
SCALE: X = -180 TO 120
Y = -100 TO 100



LOFAC COMPARISON WITH ZOT.14 RUN 502

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 503 PAGE 1

THERE WERE 0 MISSES

THEY WERE REPS #:

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

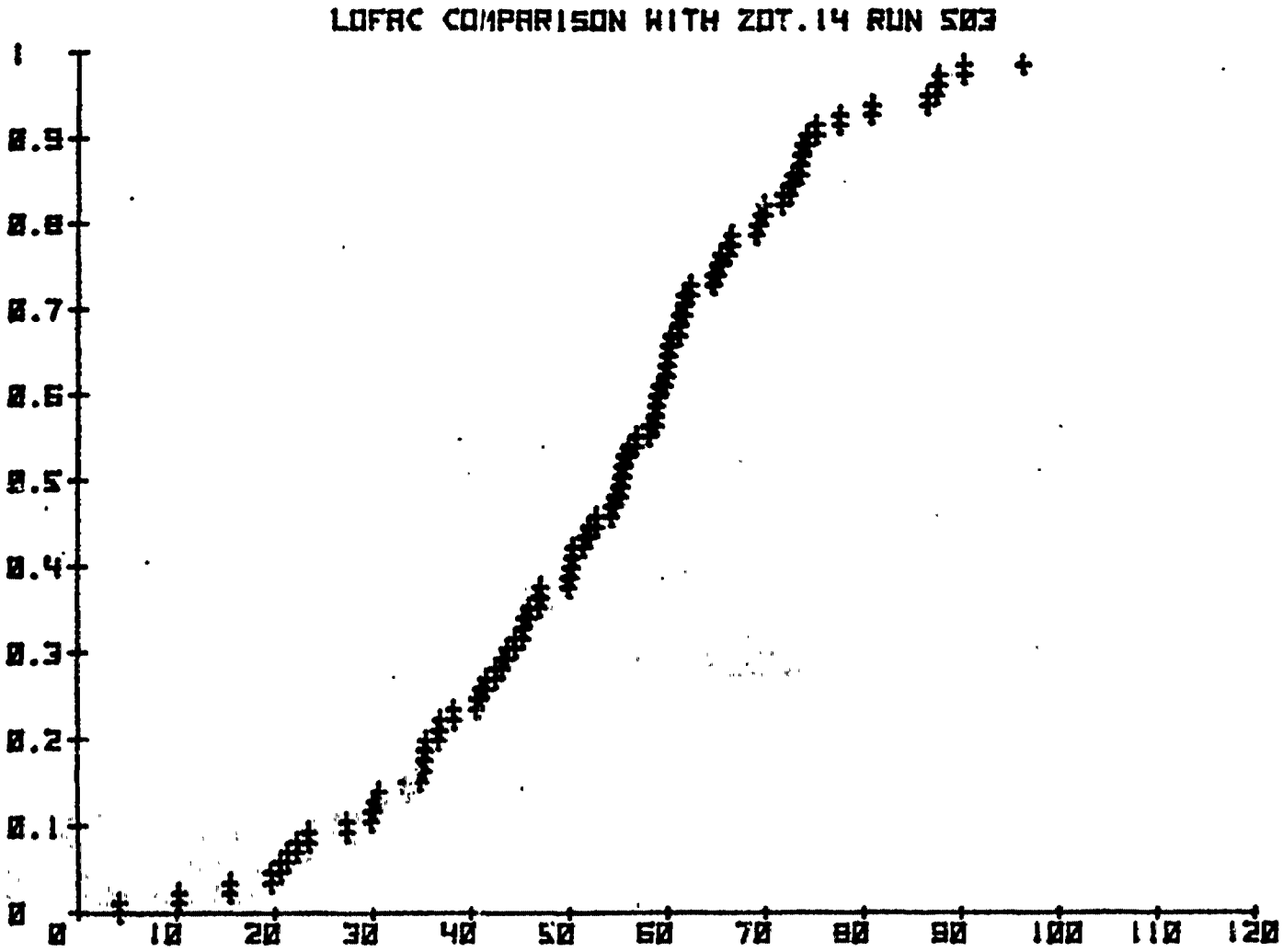
80	4.1839	63	36.7108	18	50.3585	35	59.1181	64	69.4942
37	10.2611	41	36.9407	45	50.3815	52	59.7783	67	69.9121
32	15.4455	14	38.2810	77	51.5214	15	59.8889	9	71.7556
8	19.6127	25	40.6044	68	51.9673	10	60.0195	7	72.5163
36	20.5699	43	41.0354	34	52.7672	50	60.1468	75	72.8094
74	21.2532	42	41.5678	19	54.2523	21	60.4108	55	73.6107
39	22.2652	54	42.5477	12	54.6117	48	61.2175	62	73.6466
81	23.4505	3	43.2281	61	55.1266	66	61.2450	28	73.8586
59	27.3439	23	43.7058	76	55.3390	20	61.6888	26	74.3280
22	29.8151	17	44.4785	1	55.4637	47	61.7395	38	75.2382
65	30.1395	83	45.3093	40	55.6024	51	62.3793	24	77.6231
49	30.6584	46	45.4214	30	56.0910	73	64.6423	56	80.9076
16	33.4997	79	45.9469	4	56.8172	57	65.1562	13	86.5597
11	34.8313	53	46.9440	44	58.0863	5	65.4862	6	87.4426
82	35.2709	84	47.1101	60	58.7648	2	66.2454	72	87.7457
71	35.2995	58	49.9479	85	58.8081	78	66.6161	29	90.3053
27	35.4525	69	50.1703	70	58.9238	33	69.1248	31	96.3547

OBLIQUITY MEAN 52.9788 DEG, STANDARD DEVIATION 18.9844 DEG

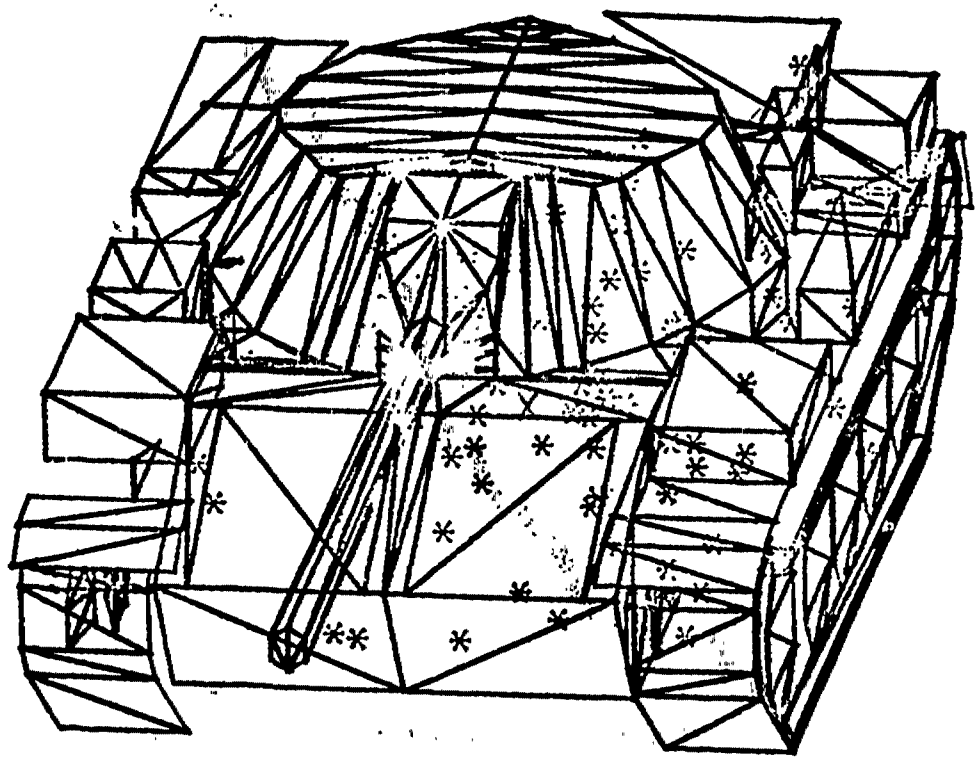
PERCENTILES:

RANK	DEVIATE
0.05	19.90
0.10	25.79
0.15	33.22
0.20	35.70
0.25	40.82
0.30	43.61
0.35	46.05
0.40	50.25
0.45	52.53
0.50	55.34
0.55	57.20
0.60	59.04
0.65	60.13
0.70	61.70
0.75	65.32
0.80	69.42
0.85	72.89
0.90	74.69
0.95	87.18

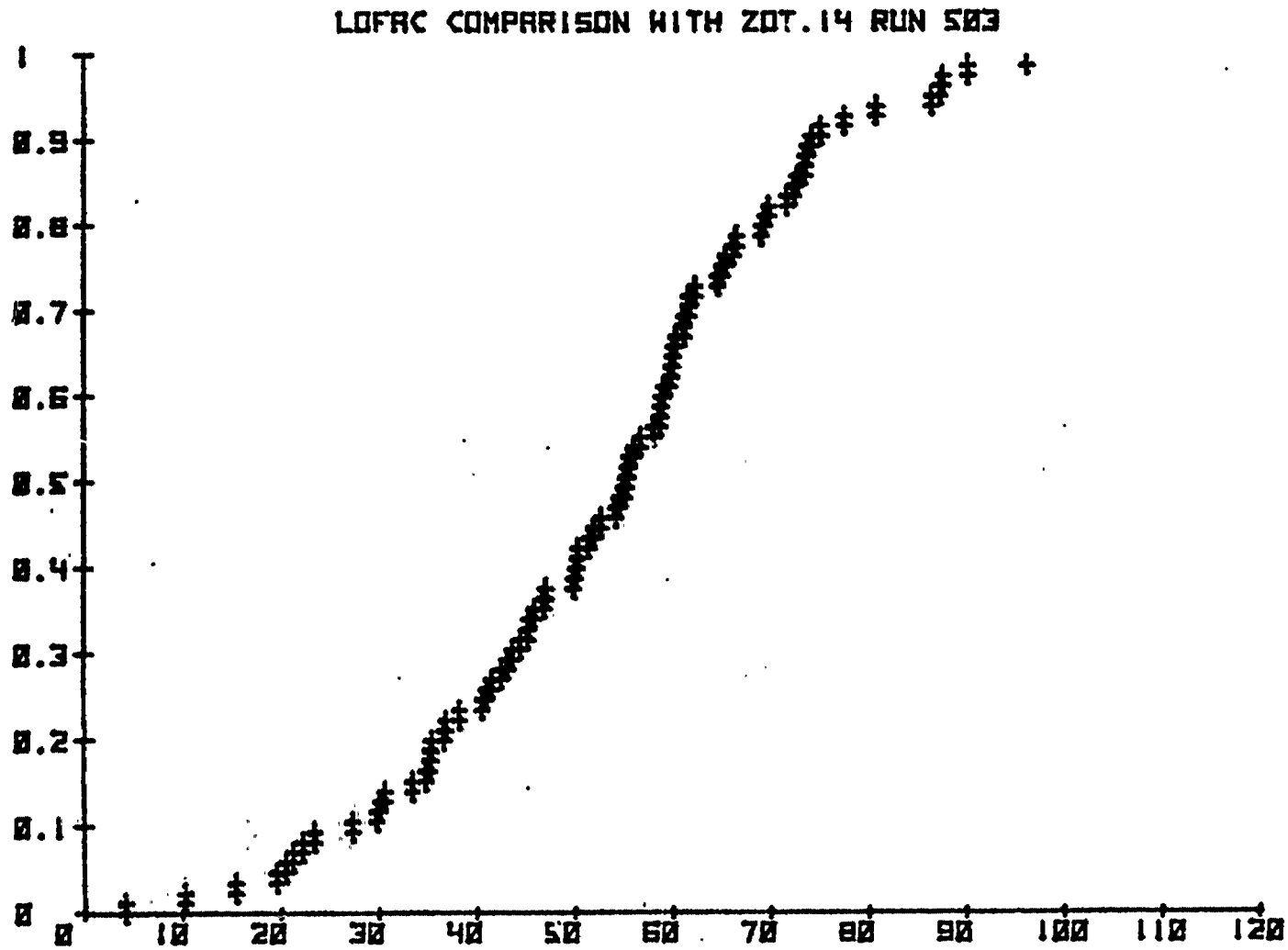
FACET NO.	NO. OF IMPACTS
136	9
231	7
182	6
-283	3
242	3
244	3
-134	2
66	2
134	2
142	2
238	2
248	2
277	2
283	2
284	2
286	2
-286	1
-271	1
-270	1
-239	1
-234	1
-137	1
-136	1
-135	1
-65	1
25	1
28	1
44	1
65	1
108	1
144	1
146	1
155	1
178	1
179	1
187	1
234	1
235	1
236	1
240	1
243	1
245	1
246	1
253	1
254	1
270	1
272	1
281	1
287	1
296	1


LOFRC COMPARISON WITH ZOT.14 RUN 503
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 71.1 PHI = 8.9
SCALE: X = -100 TO 120
Y = -100 TO 100



LOFAC COMPARISON WITH ZOT.14 RUN 503


LOFRC COMPARISON WITH ZOT.14 RUN 503
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 504 PAGE 1

THERE WERE 9 MISSES

THEY WERE REPS #: 14 20 33 54 58 59 61 65 79

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

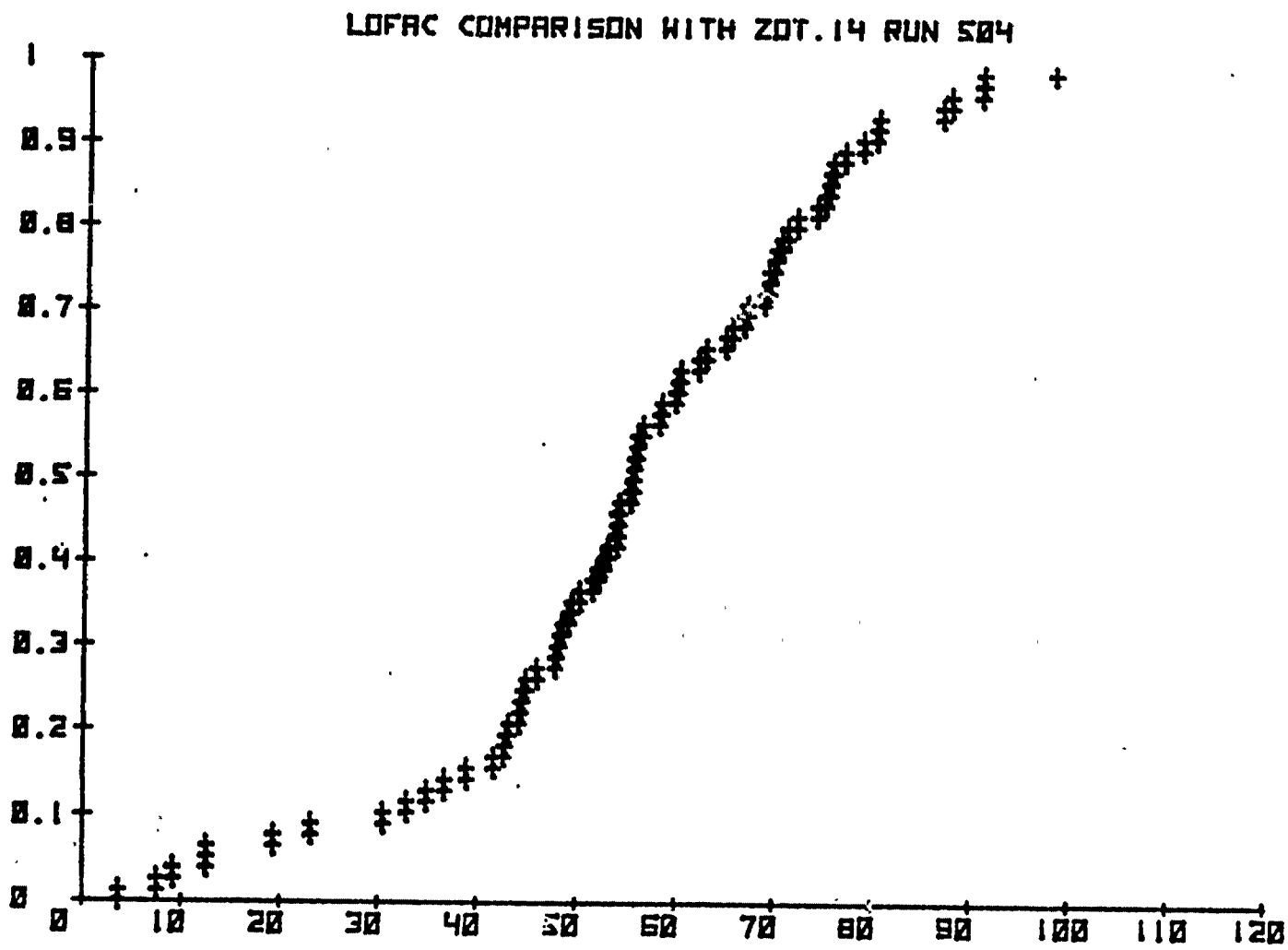
60	3.6170	63	44.3830	27	54.1673	73	65.5353	15	78.6665
37	7.4859	23	44.5685	18	54.2417	81	66.6791	4	80.0468
35	9.1386	10	44.9518	5	55.3083	3	67.0109	49	80.2929
31	12.5092	77	46.0155	1	55.6043	2	68.7993	50	86.7401
43	12.5E28	67	47.8097	55	55.6162	13	69.2182	29	87.6173
8	19.3335	7	48.0123	12	55.6940	68	69.2445	72	90.7508
11	23.1640	51	48.2250	56	55.9639	36	69.7715	6	90.8919
82	30.5102	46	48.5805	52	56.0082	76	69.9600	70	98.2156
84	32.9208	83	49.1789	69	56.5646	9	70.5071		
16	34.9365	62	49.5161	19	58.1672	47	71.0278		
39	36.7522	45	50.2394	48	58.4102	75	72.0379		
66	38.9846	80	51.5764	21	59.7866	28	74.0403		
17	41.6897	53	52.1244	41	60.0218	26	74.8501		
25	42.7126	78	52.7277	44	60.2875	22	75.1814		
42	42.8750	40	53.1010	85	62.0982	34	75.3824		
24	43.2114	32	53.9393	71	62.8835	74	75.6561		
64	44.2135	30	54.1002	57	64.8466	38	76.7852		

OBLIQUITY MEAN 55.3453 DEG, STANDARD DEVIATION 19.9151 DEG

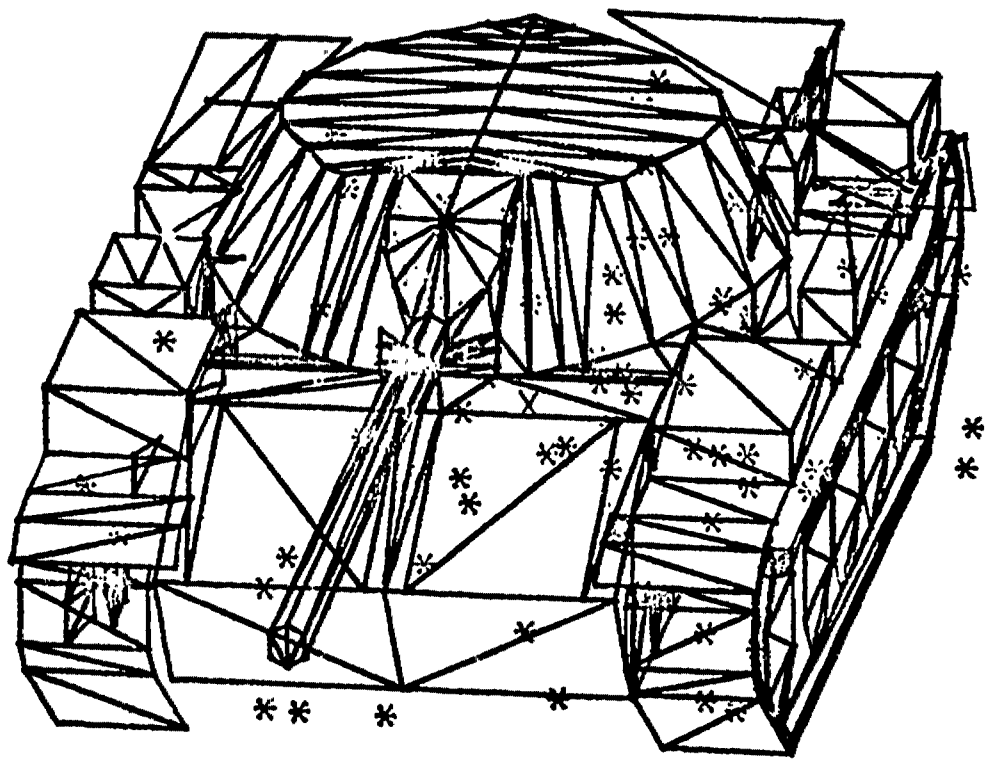
PERCENTILES:

RANK	DEVIATE
0.05	12.00
0.10	28.31
0.15	37.98
0.20	43.01
0.25	44.66
0.30	48.03
0.35	49.50
0.40	52.61
0.45	54.1,
0.50	55.61
0.55	56.20
0.60	59.83
0.65	62.98
0.70	66.98
0.75	69.64
0.80	71.63
0.85	75.27
0.90	79.08
0.95	88.09

FACET NO.	NO. OF IMPACTS
136	6
-283	3
144	3
182	3
231	3
242	3
-241	2
44	2
68	2
178	2
213	2
238	2
246	2
253	2
284	2
295	2
-296	1
-294	1
-290	1
-286	1
-278	1
-271	1
-146	1
-142	1
-136	1
-134	1
33	1
65	1
66	1
83	1
108	1
132	1
134	1
135	1
137	1
146	1
183	1
184	1
193	1
232	1
234	1
244	1
245	1
248	1
269	1
273	1
280	1
283	1
286	1
298	1
299	1


LOFAC COMPARISON WITH ZOT.14 RUN 504
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 71.1 PHI = 8.9
SCALE: X = -100 TO 120
Y = -100 TO 100



LOFAC COMPARISON WITH ZOT.14 RUN 504

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH 70T.14 RUN 505 PAGE 1

THERE WERE 0 MISSES

THEY WERE REPS #:

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

67	22.0860	84	51.9849	38	59.2488	52	68.3851	42	72.2159
32	22.8792	62	52.5069	50	59.6074	21	68.8603	7	72.4558
48	23.2307	77	53.4278	72	59.9154	47	69.2812	8	72.8320
30	24.5650	82	53.5386	53	60.1848	17	69.9212	39	72.8807
27	26.3667	51	53.8085	6	60.3121	40	70.0526	63	72.9218
65	27.8092	60	54.4368	66	60.5101	69	70.0603	9	72.9938
79	43.9909	14	54.6933	13	61.5991	22	70.1475	16	73.2668
49	47.7259	31	54.9170	4	62.5504	71	70.2748	10	73.8282
81	48.9563	55	55.0572	64	62.6270	36	70.4060	34	74.1040
85	49.4006	54	55.1113	74	64.8809	41	70.4689	43	74.1661
82	49.8887	73	55.8679	76	64.8830	35	70.5077	1	74.3575
61	50.1878	46	57.8055	68	65.2724	70	70.8629	5	74.8915
75	50.4946	29	58.3083	45	65.7295	26	71.4246	24	75.6988
56	50.6977	23	58.4552	33	65.7633	25	71.7400	57	75.7650
58	51.6496	3	58.7194	78	66.2546	28	71.8508	2	76.4429
44	51.7920	19	58.9552	80	66.3173	11	72.1256	18	76.8455
37	51.8960	15	59.0541	59	66.5074	11	72.1256	12	76.9873

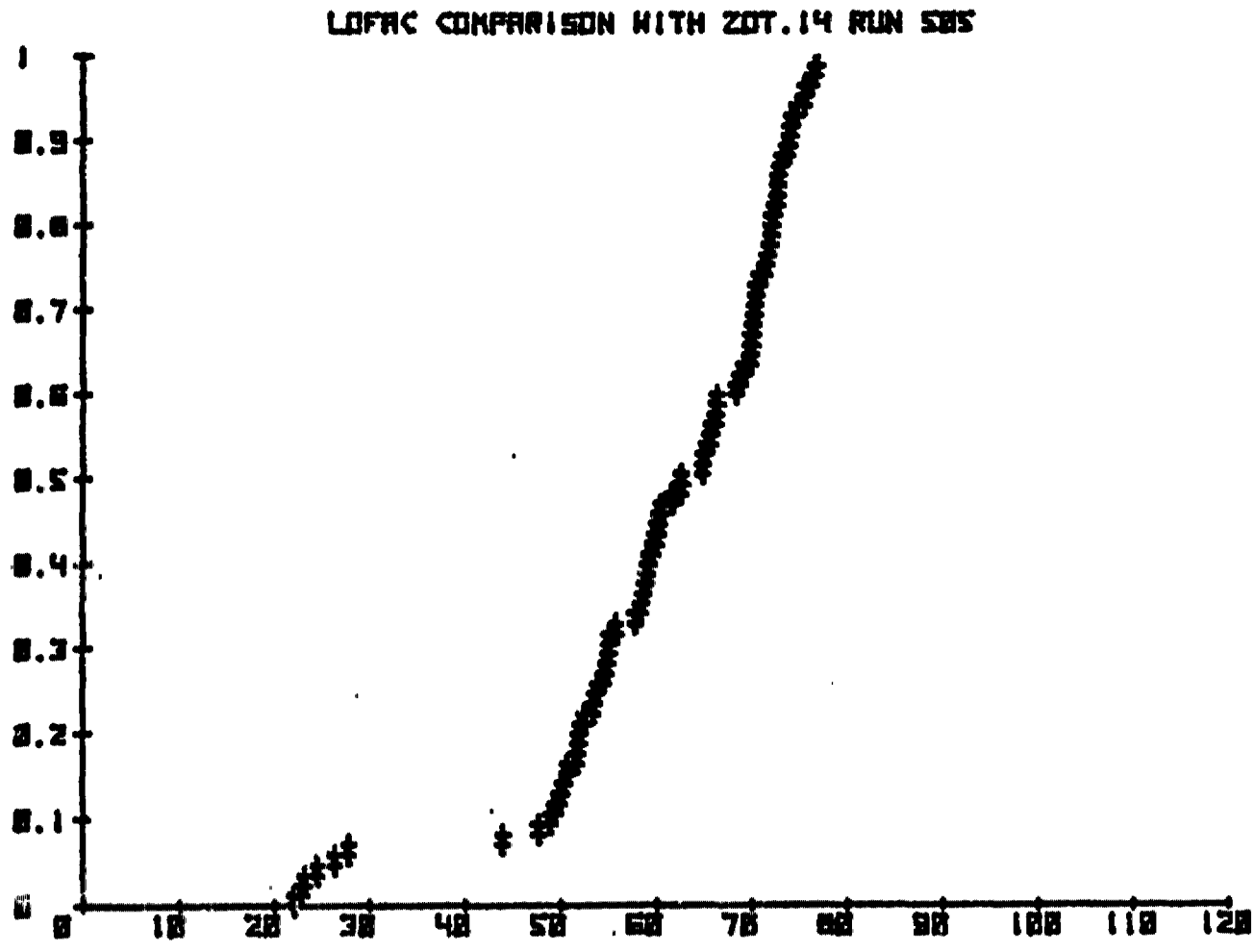
OBLIQUITY MEAN 60.8656 DEG, STANDARD DEVIATION 13.2873 DEG

PERCENTILES:

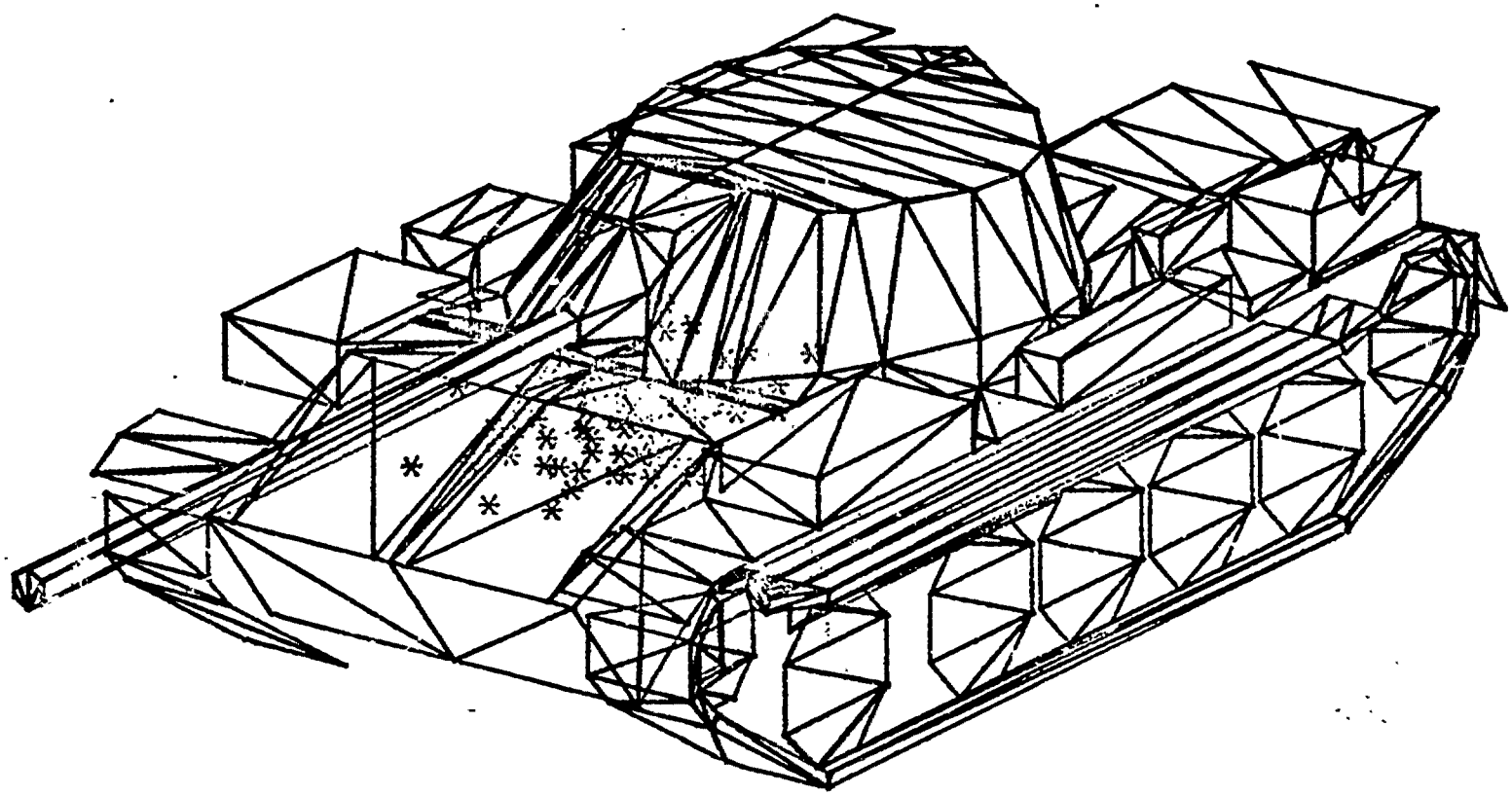
RANK	DEVIATE
0.05	25.11
0.10	48.46
0.15	50.46
0.20	51.91
0.25	53.67
0.30	55.03
0.35	58.32
0.40	59.13
0.45	60.27
0.50	62.63
0.55	65.74
0.60	67.63
0.65	70.04
0.70	70.42
0.75	71.58
0.80	72.20
0.85	72.93
0.90	74.13
0.95	75.75

LOFAC COMPARISON WITH JUT.14 RUN 505

FACET NO.	NO. OF IMPACTS
231	28
136	26
-232	5
232	4
234	4
-137	3
270	3
137	2
-136	1
135	1
171	1
233	1
235	1
240	1
241	1
242	1
275	1
287	1


LOFAC COMPARISON WITH ZOT.14 RUN 585
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 69.9 PHI = 36.2
SCALE: X = -250 TO 50
Y = -100 TO 100



LOFAC COMPARISON WITH ZOT.14 RUN 505

THERE WERE 0 MISSES

THEY WERE REPS #:

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

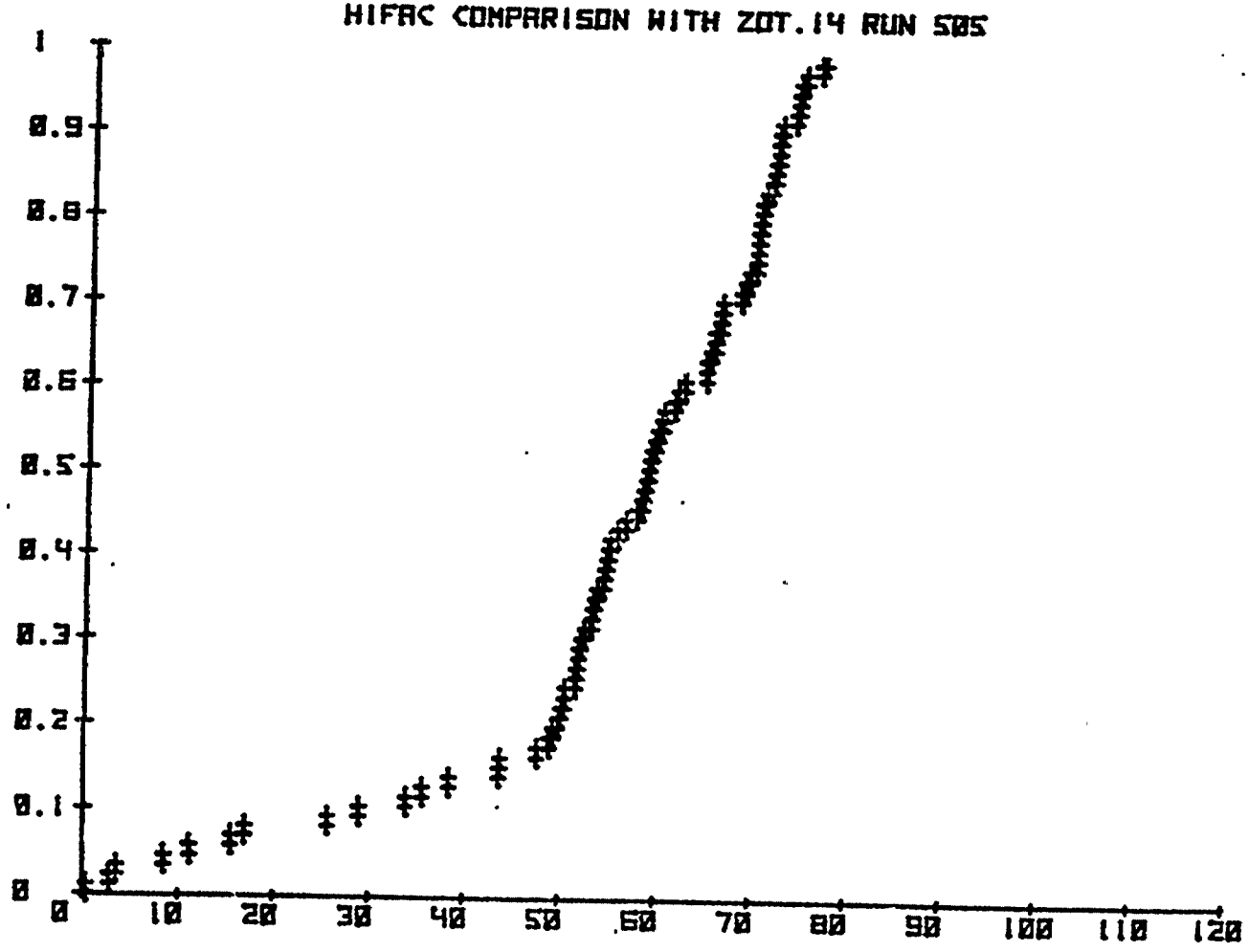
48	0.3532	83	49.8087	54	54.9467	64	62.6270	41	70.4680
53	2.8084	61	50.1878	55	55.0572	74	64.8809	35	70.5077
27	3.5585	75	50.4946	73	55.8679	76	64.8830	70	70.8629
65	8.4747	56	50.5393	12	56.7405	68	65.2724	26	71.4246
30	11.1497	44	51.6200	46	57.8055	45	65.7295	25	71.7400
32	15.5448	58	51.6496	29	58.3083	33	65.7633	28	71.8508
16	16.9585	84	51.8586	23	58.4552	78	66.2546	11	72.1256
67	25.7072	37	51.8960	3	58.7194	80	66.3173	11	72.1256
39	28.9659	36	52.1561	19	58.9552	59	66.5074	42	72.2159
8	33.9039	62	52.5069	15	59.0541	52	68.3851	7	72.4558
63	35.6123	4	53.2961	38	59.2488	21	68.8603	10	73.8282
57	38.4386	77	53.2978	50	59.6074	47	69.2812	34	74.1040
24	43.7151	82	53.5386	72	59.9154	17	69.9212	43	74.1661
79	43.8270	51	53.8085	6	60.3121	40	70.0526	1	74.3575
49	47.7259	60	54.4368	66	60.5101	69	70.0603	5	74.8915
81	48.9563	14	54.5026	13	61.5991	22	70.1475	2	76.4429
85	49.4006	31	54.7402	9	62.0091	71	70.2747	18	76.8455

OBLIQUITY MEAN 55.6266 DEG, STANDARD DEVIATION 17.9642 DEG

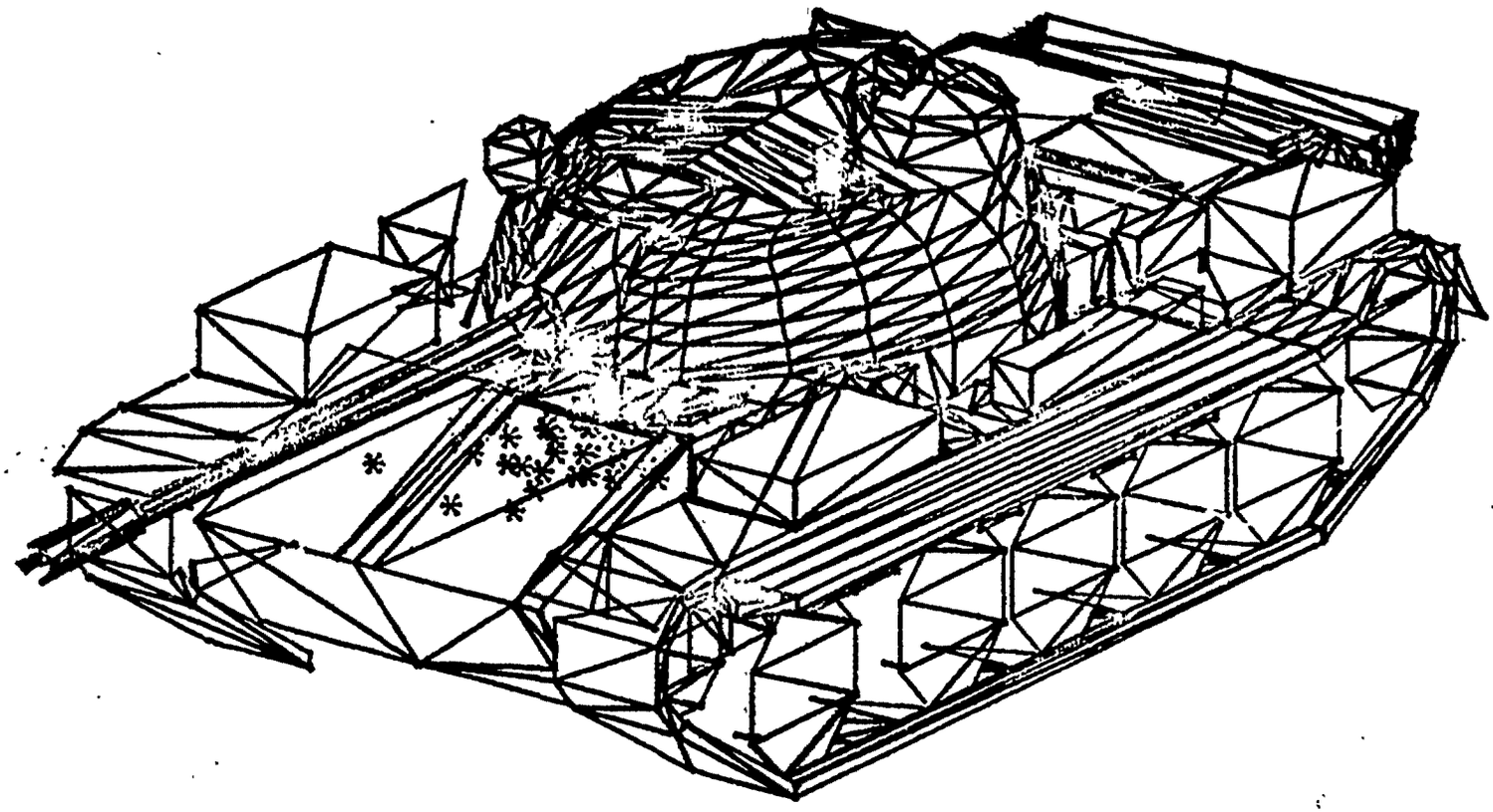
PERCENTILES:

RANK	DEVIATE
0.05	9.28
0.10	27.66
0.15	43.19
0.20	49.50
0.25	51.08
0.30	52.10
0.35	53.57
0.40	54.82
0.45	57.49
0.50	58.96
0.55	60.03
0.60	62.38
0.65	65.68
0.70	66.88
0.75	69.99
0.80	70.43
0.85	71.75
0.90	72.31
0.95	74.30

FACET NO.	NO. OF IMPACTS
399	26
254	6
256	6
305	5
-306	4
389	4
180	3
253	3
264	3
306	3
400	3
255	2
317	2
390	2
162	1
163	1
164	1
172	1
257	1
263	1
266	1
268	1
294	1
307	1
310	1
311	1
395	1


HIFRC COMPARISON WITH ZOT.14 RUN 505
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 69.8 PHI = 36.2
SCALE: X = -250 TO 50
Y = -100 TO 100



HIFAC COMPARISON WITH ZIT.14 RUN 505

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 506 PAGE 1

THERE WERE 0 MISSES

THEY WERE REPS #:

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

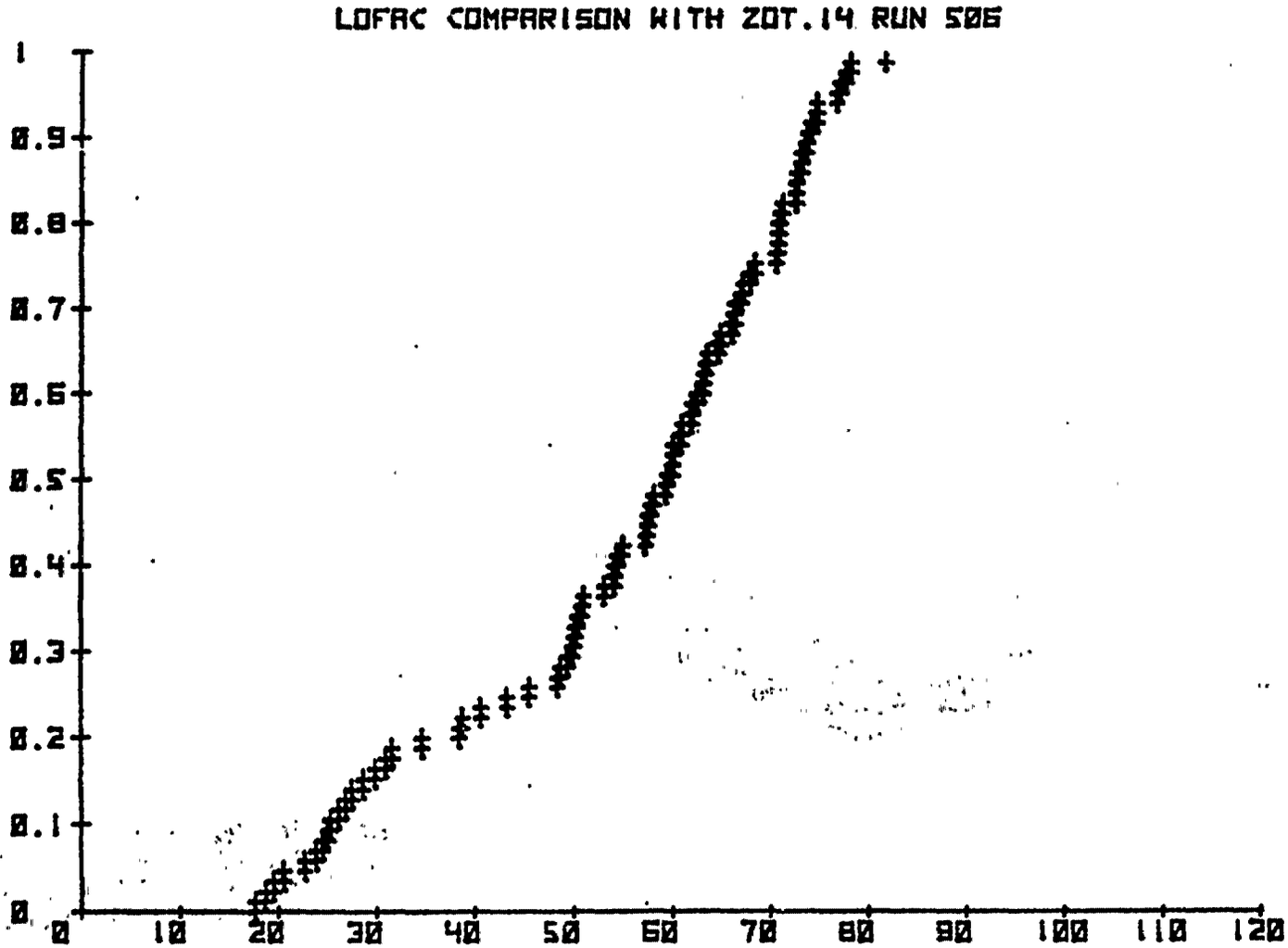
35	17.6430	26	38.4284	51	54.4535	46	63.1744	28	71.0973
76	18.6823	79	38.7159	75	54.9735	71	63.2761	9	71.3635
27	19.4781	66	40.5530	55	57.2805	6	63.4149	16	72.7091
30	20.5008	11	43.2035	64	57.4596	38	63.6363	12	72.7331
48	22.6744	32	45.4827	60	57.5615	21	64.6824	3	72.7697
59	23.8006	61	48.3057	77	57.8553	50	64.9859	1	73.2166
78	24.4740	72	48.6527	82	58.1594	17	66.0902	42	73.2532
67	25.0170	37	49.3159	81	59.3067	13	66.3956	70	73.7509
40	25.2384	36	49.6070	73	59.4454	80	66.4341	10	73.8950
47	26.0633	85	49.9992	56	60.0093	22	67.0670	39	74.2604
33	26.7997	15	50.1514	18	60.0495	52	67.2733	29	74.7762
69	27.4788	44	50.3953	54	60.1169	84	67.9777	5	74.8536
45	28.6454	83	50.8258	23	60.9112	31	68.5066	63	76.8561
34	29.8298	58	50.9810	41	61.0101	49	70.6497	43	77.2013
4	30.9235	62	53.0717	68	61.9651	20	70.8311	2	77.7699
65	31.5656	53	54.0582	19	62.0422	7	70.8652	24	78.2834
25	34.6485	14	54.1646	74	62.5536	8	70.9388	57	81.8724

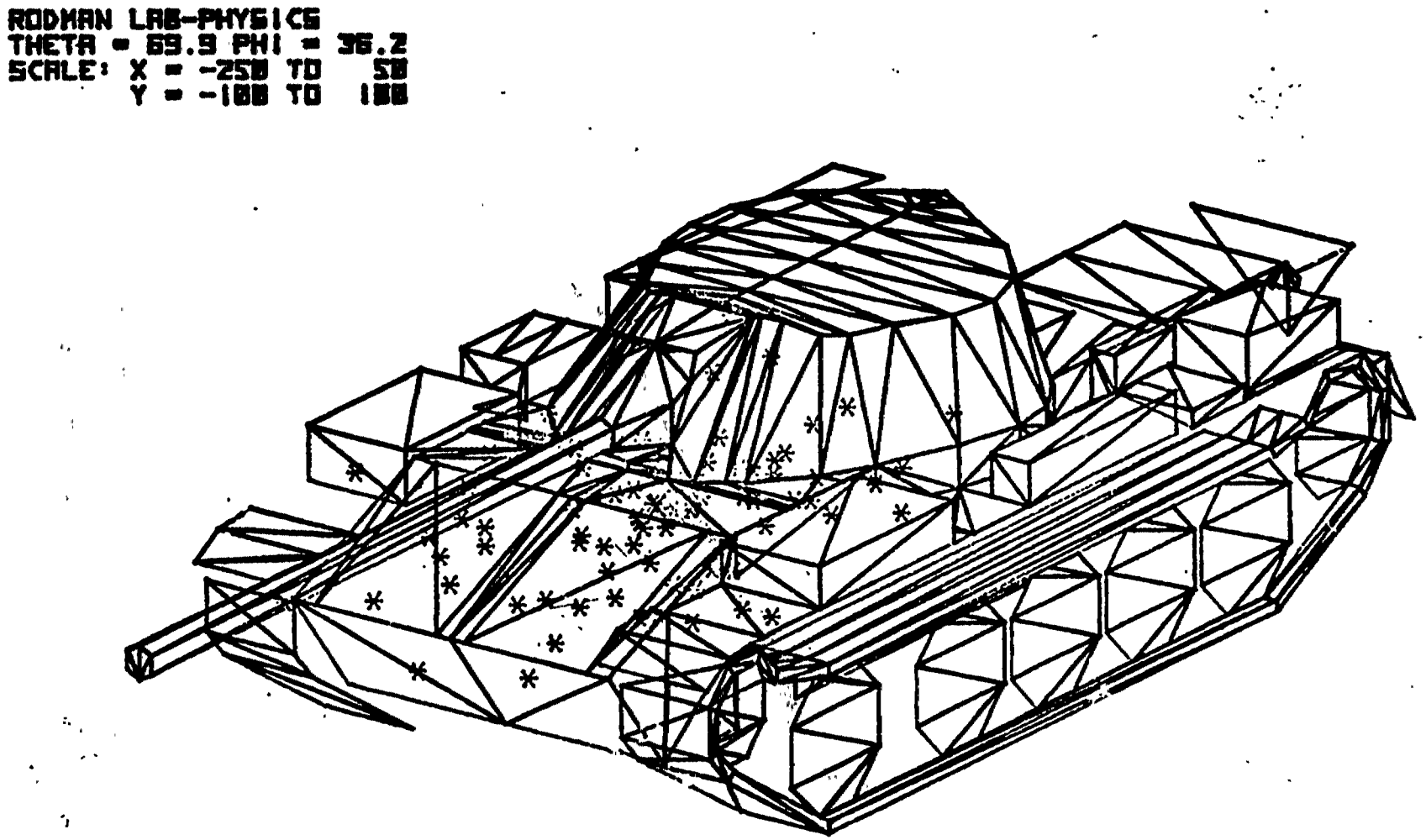
OBLIQUITY MEAN 54.8422 DEG, STANDARD DEVIATION 17.6032 DEG

PERCENTILES:

RANK	DEVIATE
0.05	21.15
0.10	25.15
0.15	28.53
0.20	35.40
0.25	44.34
0.30	49.71
0.35	50.84
0.40	54.28
0.45	57.53
0.50	59.45
0.55	60.94
0.60	62.93
0.65	64.58
0.70	66.56
0.75	69.58
0.80	71.07
0.85	72.81
0.90	74.04
0.95	77.10

FACET NO.	NO. OF IMPACTS
136	15
231	11
178	6
-136	5
242	5
287	4
144	3
-231	2
146	2
171	2
238	2
240	2
286	2
-242	1
-232	1
-137	1
-134	1
134	1
135	1
137	1
182	1
197	1
232	1
233	1
234	1
235	1
241	1
244	1
247	1
253	1
270	1
275	1
277	1
278	1
281	1
284	1
290	1


LOFRC COMPARISON WITH ZOT.14 RUN 506
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120



LOFRC COMPARISON WITH ZOT.14 RUN 586

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 507 PAGE 1

THERE WERE 4 MISSES

THEY WERE REPS #: 4 54 60 72

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

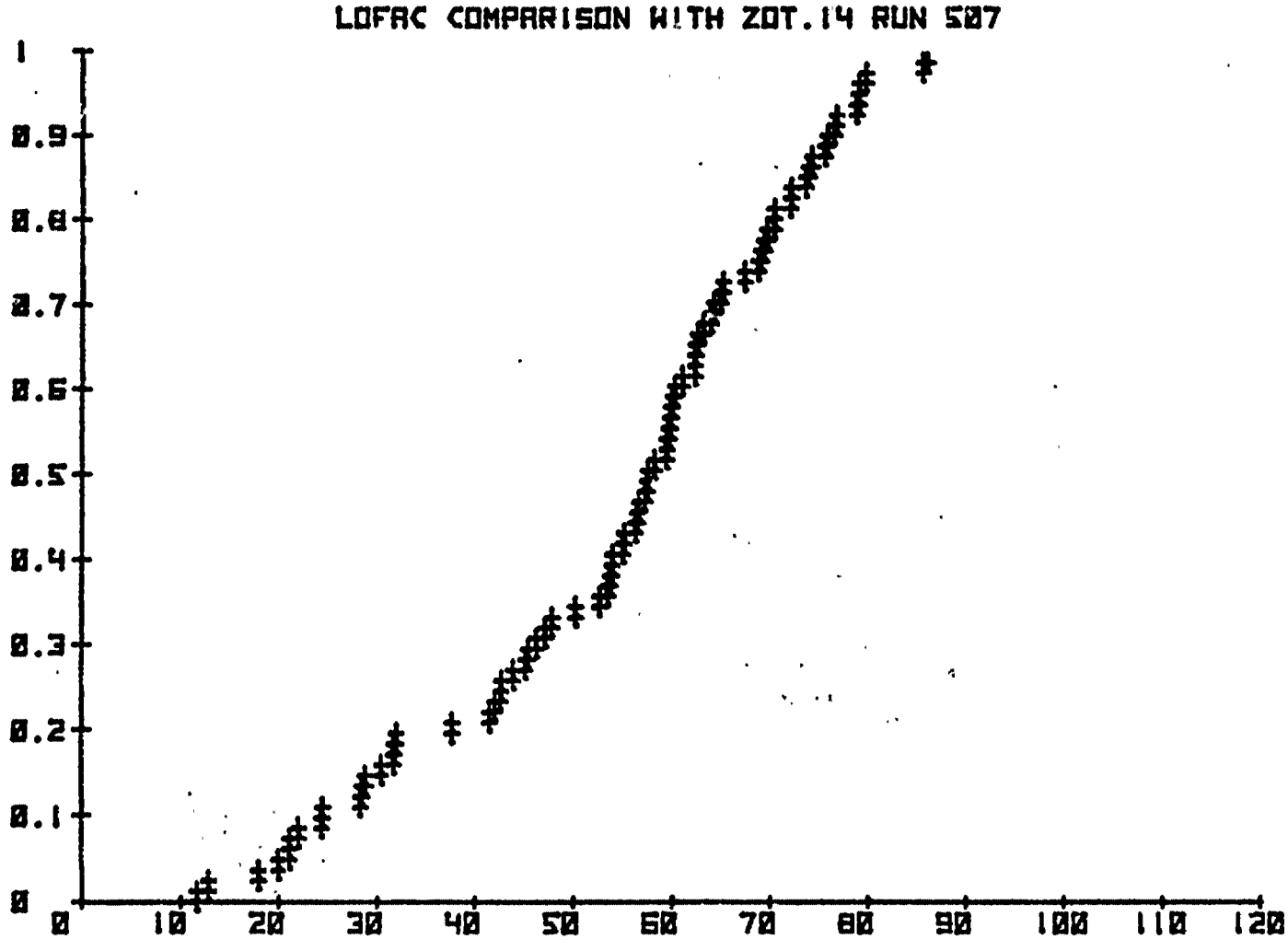
45	11.6708	49	41.5258	51	55.1536	75	62.4010	44	73.7174
11	12.8563	13	42.0603	3	56.2674	18	62.4499	10	73.9872
12	17.9603	26	42.6846	73	56.4692	17	62.6839	42	74.3559
48	19.9959	24	42.7386	31	56.7109	23	63.2524	39	75.6391
33	21.0715	81	43.9194	21	57.2707	29	64.0268	71	75.9114
76	21.1723	79	45.1667	5	57.5066	22	64.3392	70	76.5873
25	22.0726	38	45.4764	53	57.5980	19	65.0163	84	76.8494
40	24.4104	61	46.2651	32	58.2548	6	65.2562	34	78.8731
41	24.5083	37	47.1439	55	59.4279	46	67.4836	2	79.1204
78	28.3602	36	47.8336	68	59.4738	7	68.8741	50	79.1614
35	28.5224	85	50.2373	14	59.7543	8	69.0930	43	79.9019
67	28.8770	83	52.6851	80	59.8534	20	69.4368	66	85.7056
30	30.5098	56	53.5269	74	59.9357	9	69.7901	57	86.1316
69	31.7529	62	53.7490	77	60.0969	59	70.4666		
59	31.8297	65	53.9341	63	60.3296	28	70.5322		
47	32.0216	64	53.9861	52	61.1057	1	72.1613		
15	37.6997	27	55.0482	82	62.3906	16	72.2387		

OBLIQUITY MEAN 54.2755 DEG, STANDARD DEVIATION 18.4882 DEG

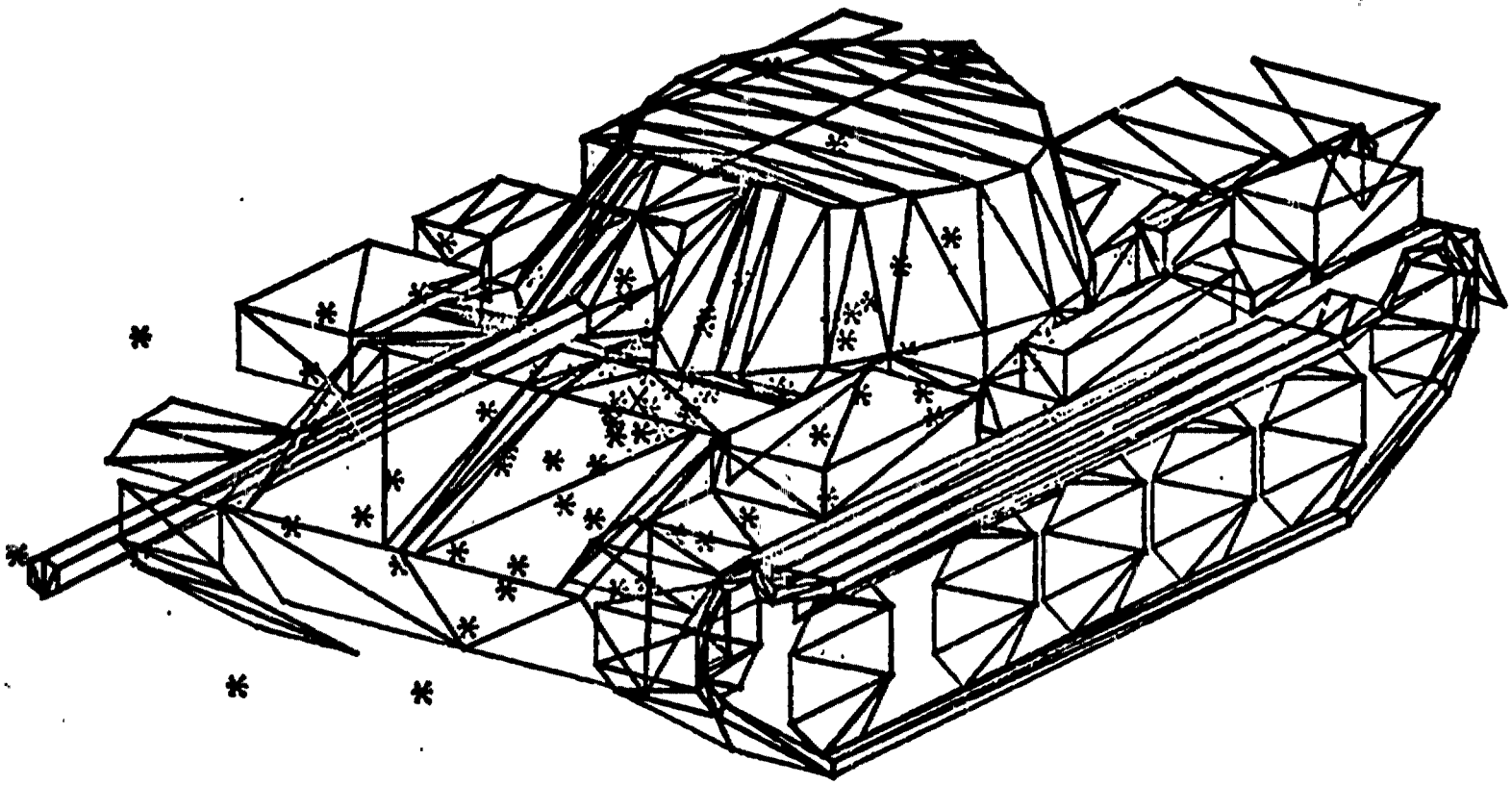
PERCENTILES:

RANK	DEVIATE
0.05	20.10
0.10	24.43
0.15	29.37
0.20	34.29
0.25	42.71
0.30	45.95
0.35	51.95
0.40	53.98
0.45	56.45
0.50	57.60
0.55	59.76
0.60	60.48
0.65	62.52
0.70	64.61
0.75	68.98
0.80	70.51
0.85	73.91
0.90	76.45
0.95	79.16

FACET NO.	NO. OF IMPACTS
136	12
231	7
-136	3
178	3
244	3
286	3
-134	2
134	2
144	2
177	2
179	2
187	2
193	2
232	2
235	2
238	2
277	2
-298	1
-242	1
-235	1
-232	1
-135	1
-67	1
28	1
47	1
49	1
137	1
142	1
146	1
168	1
183	1
197	1
203	1
233	1
239	1
243	1
246	1
247	1
253	1
281	1
283	1
284	1
287	1
293	1
296	1


LOFAC COMPARISON WITH ZOT.14 RUN 507
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 89.9 PHI = 90.2
SCALE: X = -250 TO 50
Y = -100 TO 100



LOFRC COMPARISON WITH ZOT.14 RUN 507

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 508 PAGE 1

THERE WERE 11 MISSES

THEY WERE REPS #: 4 10 14 38 41 49 53 54 60 72 73

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

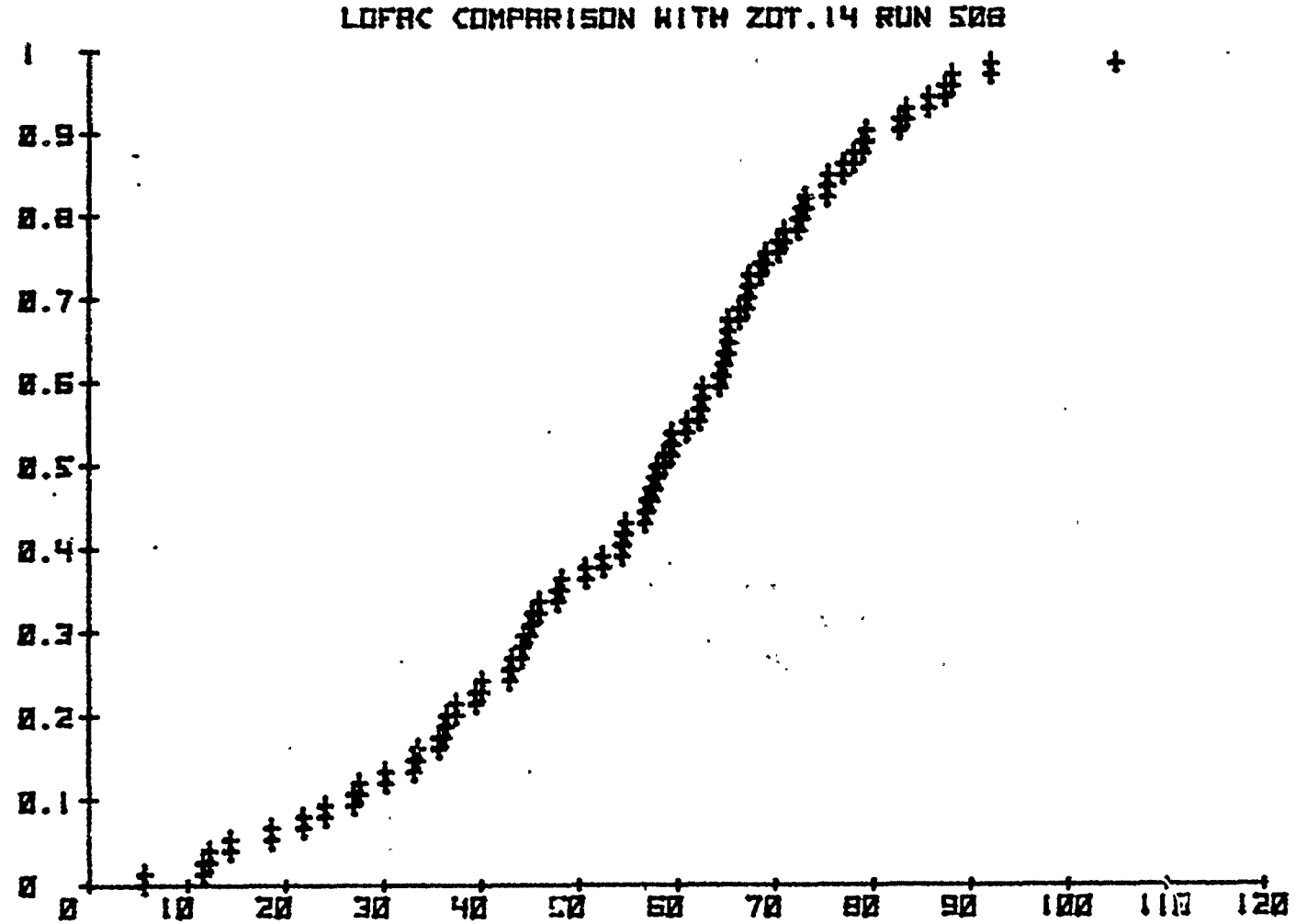
45	5.6225	40	40.0863	68	57.3737	50	67.1594	65	83.5200
7	11.5383	46	42.9248	17	57.6809	8	67.3152	12	85.7824
26	12.2265	16	43.1970	27	57.9794	19	67.4094	66	87.4493
11	14.3598	61	44.1582	74	58.6615	20	68.5527	57	88.2292
76	18.5486	34	44.3358	2	59.3853	32	69.1287	13	92.1651
67	21.7836	58	44.9502	56	59.5235	38	70.3224	80	104.9580
29	24.0147	37	45.2544	55	61.0906	1	71.0057		
35	26.9186	36	45.9346	63	62.2861	5	72.4016		
30	27.5369	21	47.7739	22	62.5688	25	72.7721		
48	30.1948	79	48.2170	77	62.6296	51	73.1925		
78	33.1463	81	50.6758	82	64.3420	15	75.4006		
9	33.4960	64	52.4506	85	64.7501	42	75.4817		
33	35.6594	83	54.4038	52	64.8345	39	77.0191		
69	36.2445	62	54.5401	44	65.2130	31	78.0860		
47	36.4657	75	54.7408	18	65.2356	71	78.9983		
59	37.4193	3	56.7224	23	65.2896	70	79.3481		
84	39.4324	43	56.9312	6	66.3856	24	82.7767		

OBLIQUITY MEAN 55.6163 DEG, STANDARD DEVIATION 20.9073 DEG

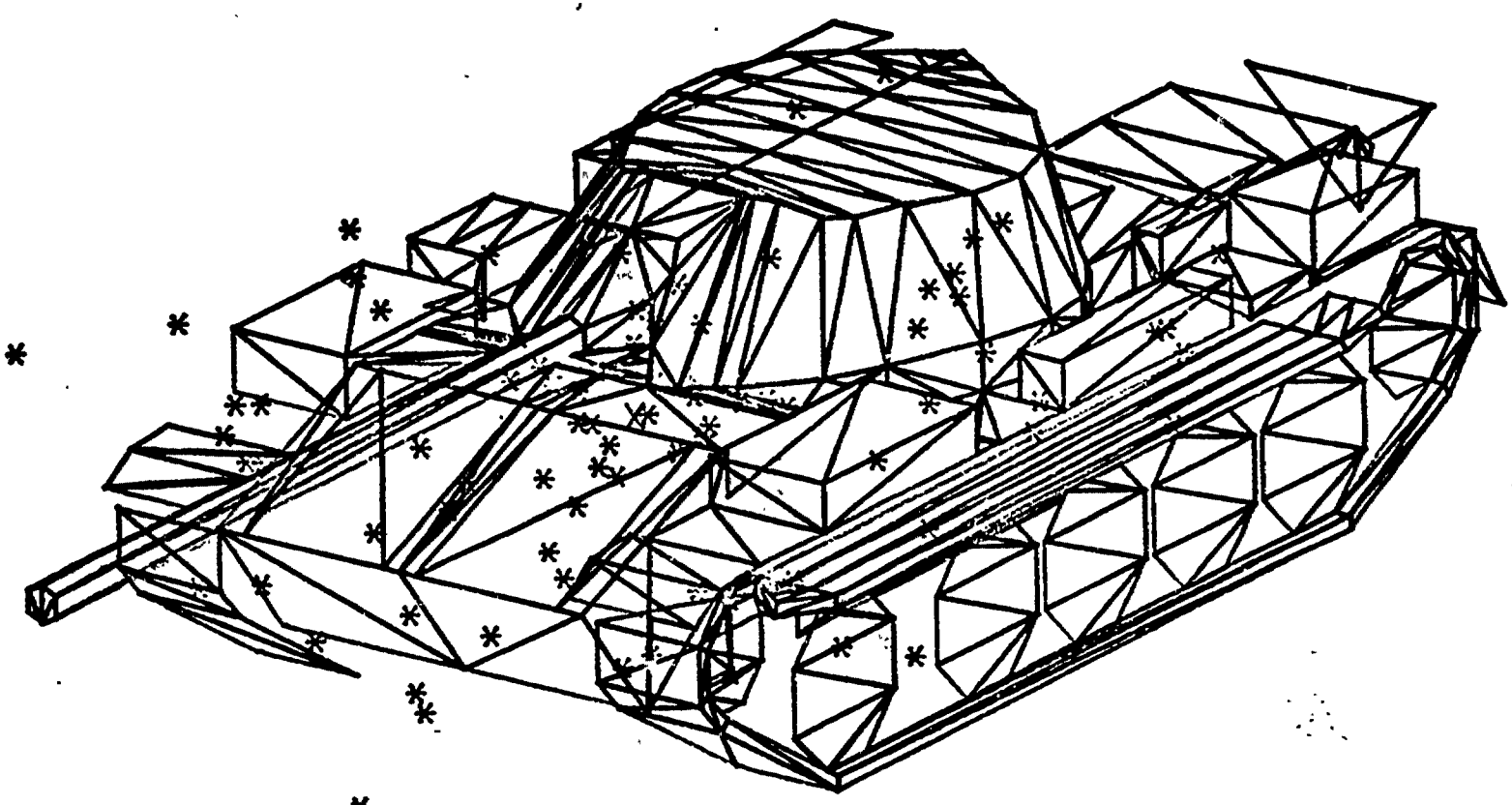
PERCENTILES:

RANK	DEVIATE
0.05	13.83
0.10	25.47
0.15	33.23
0.20	36.47
0.25	42.22
0.30	44.64
0.35	47.88
0.40	54.40
0.45	56.88
0.50	58.32
0.55	61.39
0.60	64.34
0.65	65.23
0.70	67.24
0.75	69.43
0.80	72.77
0.85	76.63
0.90	81.06
0.95	87.64

FACET NO.	NO. OF IMPACTS
136	10
-146	3
231	3
247	3
-144	2
-137	2
-136	2
-134	2
45	2
47	2
184	2
193	2
234	2
246	2
284	2
287	2
-299	1
-297	1
-278	1
-240	1
-232	1
-202	1
-91	1
-66	1
31	1
44	1
66	1
94	1
132	1
134	1
142	1
177	1
178	1
179	1
187	1
213	1
232	1
233	1
235	1
237	1
241	1
249	1
254	1
273	1
274	1
275	1
283	1


LOFRC COMPARISON WITH ZOT.14 RUN 508
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 69.9 PHI = 36.2
SCALE: X = -250 TO 50
Y = -100 TO 100



LOFRC COMPARISON WITH ZOT.14 RUN 500

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 509 PAGE 1

THERE WERE 0 MISSES

THEY WERE REPS #:

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

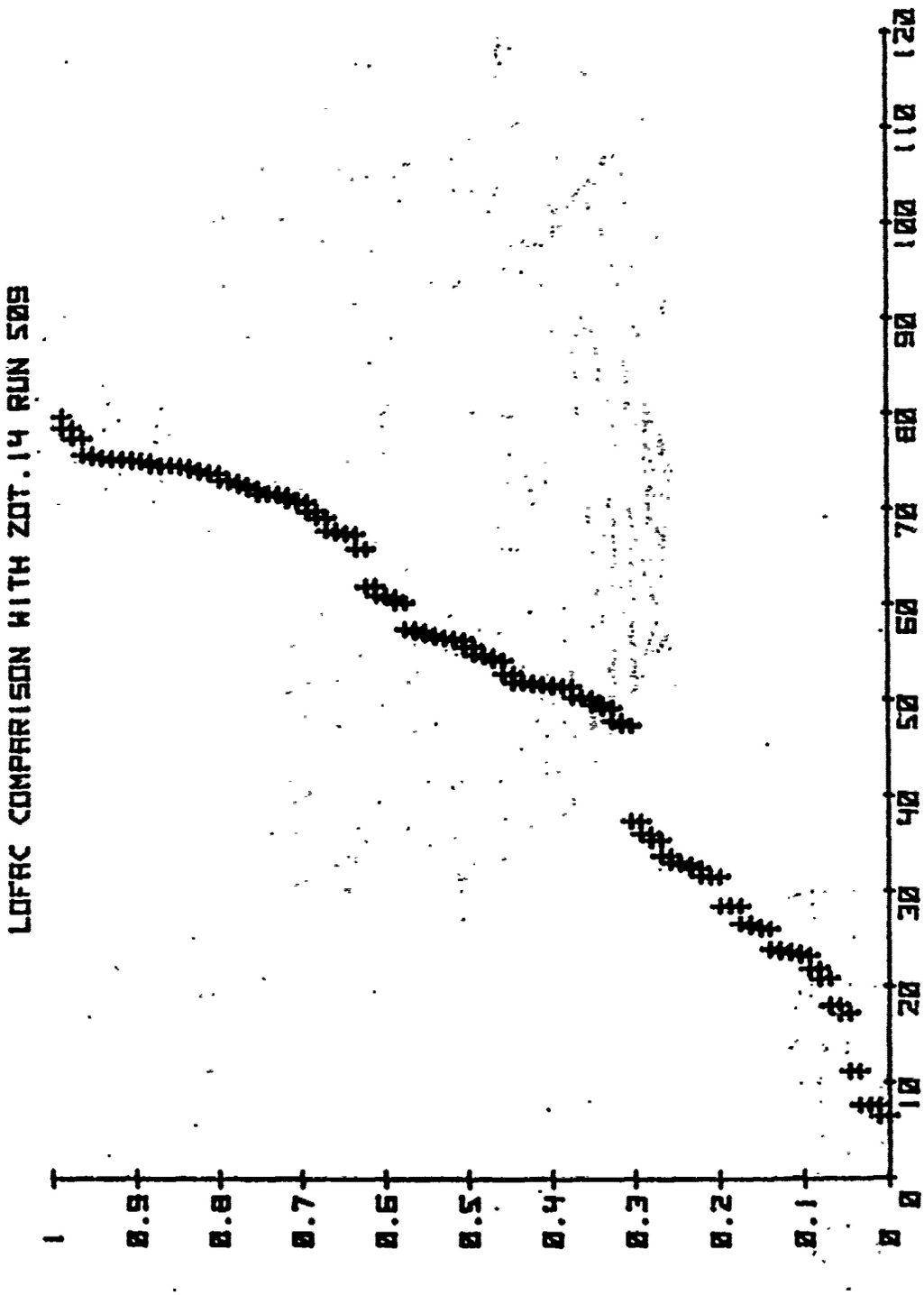
46	6.4542	83	31.5294	36	51.5962	14	60.9906	28	73.7797
12	7.6063	41	31.5948	58	51.6138	29	61.9370	16	73.9652
10	7.6115	76	32.3977	17	51.8371	40	65.8699	26	74.2056
70	11.1598	57	32.8339	45	51.8799	30	67.4152	50	74.4868
48	17.2105	23	33.0302	49	52.8015	52	67.5265	31	74.5776
72	18.0785	34	33.7336	79	54.1476	47	67.8136	9	74.6019
53	20.8869	80	35.3688	81	54.5587	59	69.1237	21	74.6652
65	21.9080	71	36.0284	44	54.7764	11	69.7942	37	75.0560
35	23.2764	19	37.3483	4	55.6058	42	70.8177	7	75.1142
82	23.5409	77	47.3179	22	56.3848	62	70.9531	24	75.2455
66	23.6714	64	47.7485	51	56.5055	85	71.5083	39	75.2633
27	23.9384	56	49.1401	54	56.5725	33	71.6170	73	75.4190
32	26.0611	84	49.5587	15	56.8690	55	71.6789	2	75.4753
78	26.3094	74	50.1562	1	57.1053	18	72.1966	8	75.7363
69	26.6351	68	50.2967	60	57.4492	25	72.5742	20	77.5053
43	28.4571	75	51.4102	3	60.2161	5	72.9039	13	78.5530
63	28.4792	61	51.4352	67	60.7045	38	73.1115	6	79.8224

OBLIQUITY MEAN 52.2860 DEG, STANDARD DEVIATION 20.8013 DEG

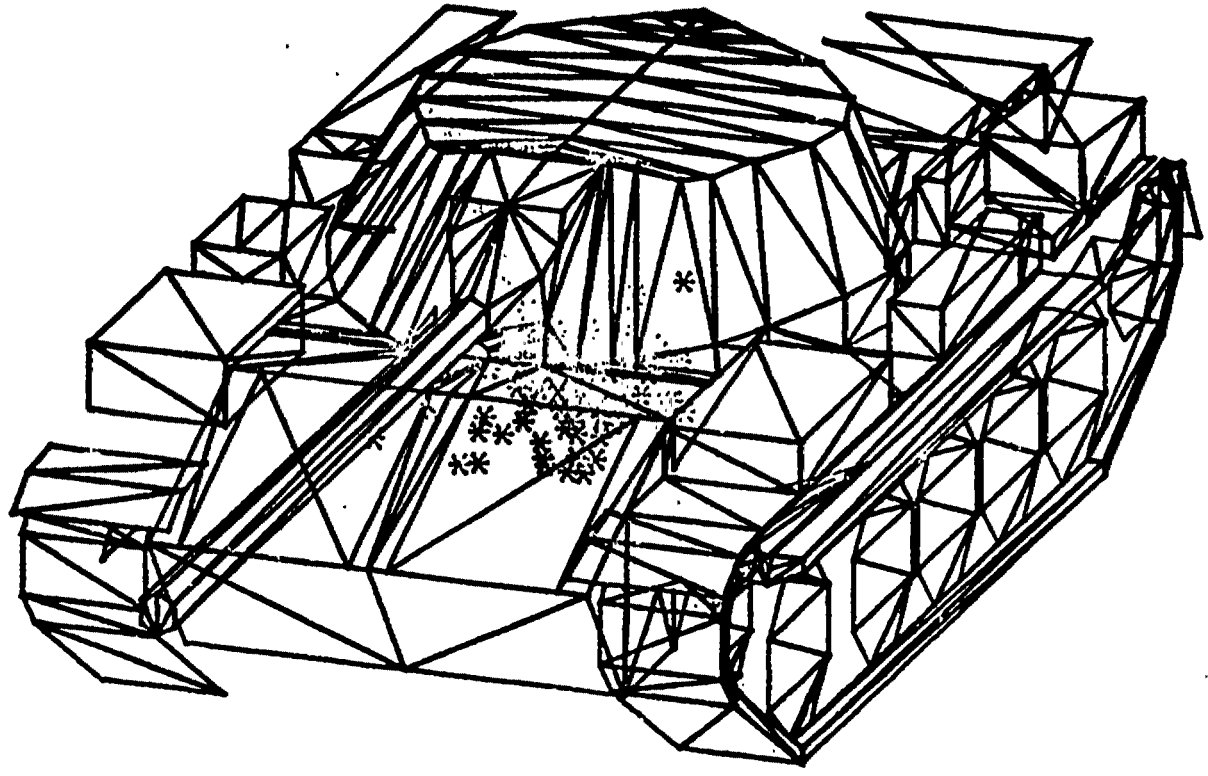
PERCENTILES:

RANK	DEVIATE
0.05	12.98
0.10	22.73
0.15	25.85
0.20	29.09
0.25	32.93
0.30	37.08
0.35	49.62
0.40	51.50
0.45	52.53
0.50	55.61
0.55	56.96
0.60	60.91
0.65	67.52
0.70	70.84
0.75	71.94
0.80	73.65
0.85	74.58
0.90	75.17
0.95	75.66

FACET NO.	NO. OF IMPACTS
231	24
136	23
238	5
274	5
240	4
242	4
277	3
-137	2
232	2
234	2
235	2
278	2
-232	1
-136	1
178	1
233	1
241	1
270	1
284	1


LOFRC COMPARISON WITH ZOT.14 RUN 509
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 71.1 PHI = 19.5
SCALE: X = -200 TO 100
Y = -100 TO 100



LOFAC COMPARISON WITH ZOT.14 RUN 509

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 510 PAGE 1

THERE WERE 0 MISSES

THEY WERE REPS #:

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

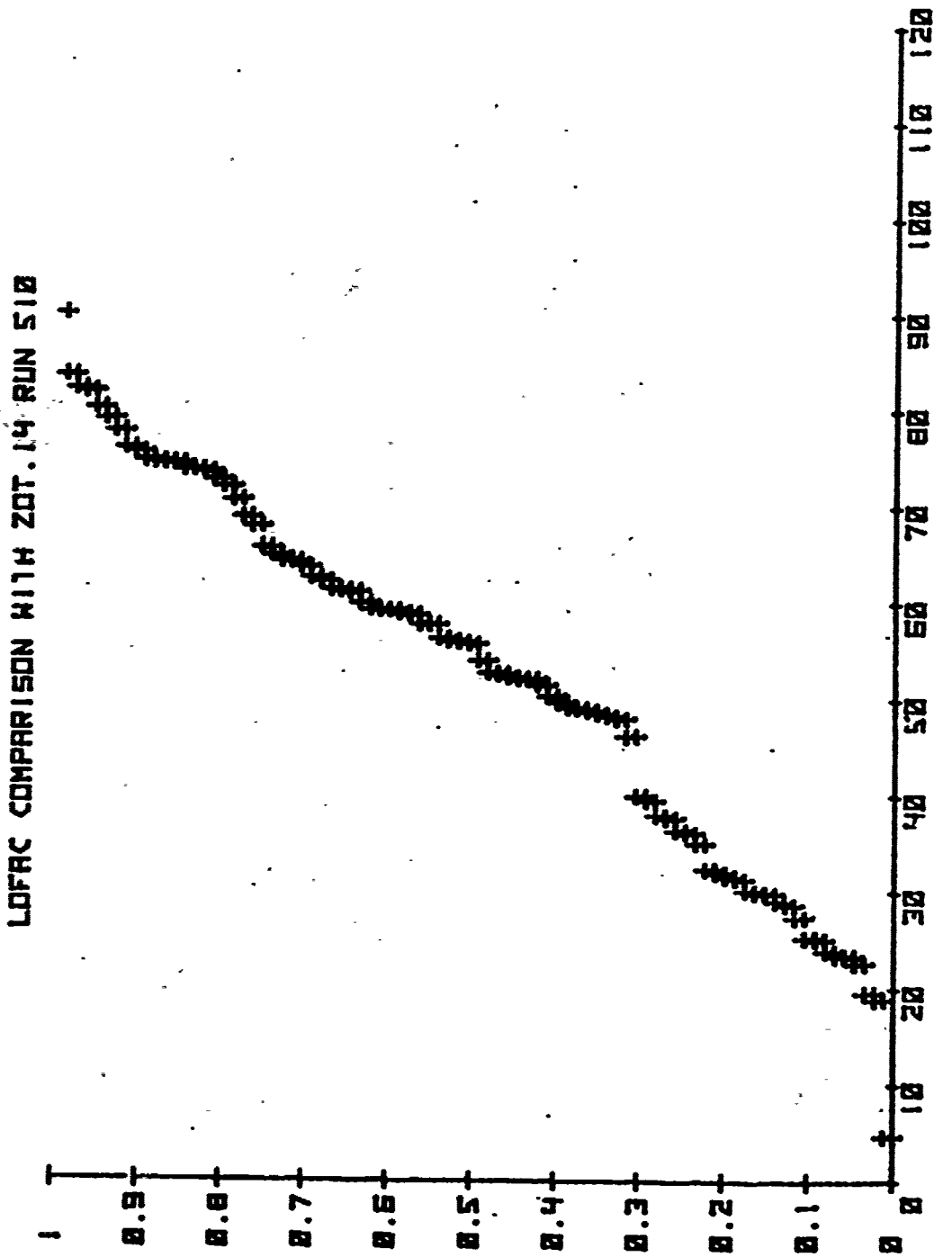
80	4.6673	57	31.9874	46	50.2935	79	59.2602	55	72.8329
48	18.8942	23	32.3642	68	51.4886	66	59.3518	9	73.6320
18	19.5747	24	35.0633	45	52.0819	40	60.0568	38	73.8174
43	22.6561	83	36.1235	84	52.1011	30	61.1786	28	73.8698
65	23.4188	12	36.3822	71	52.2646	51	61.2784	7	74.4208
82	23.4323	34	37.6285	35	52.6183	81	61.4175	26	74.5172
27	23.8882	22	37.9586	61	52.7713	5	62.2140	2	74.6190
53	25.0882	76	39.4707	58	54.0286	54	62.6418	21	74.7412
36	25.2749	19	39.9756	85	55.7181	60	63.7421	8	75.6300
63	27.3993	64	46.2060	4	55.8694	52	64.2818	31	76.0488
39	28.6864	70	47.9831	37	56.0227	47	64.3732	50	77.8185
74	29.0676	77	48.2492	16	56.3249	11	64.9655	3	79.0735
25	29.6243	10	48.4716	1	57.7580	14	65.7638	20	80.2431
78	29.9901	17	4[illegible].7849	44	57.8053	75	67.9224	13	81.9368
42	30.1948	49	49.0118	15	58.7208	29	68.8743	73	82.2064
69	31.3562	59	49.1396	32	58.9276	72	70.6884	6	83.6136
41	31.5538	56	49.6688	33	59.2472	62	72.0869	67	90.0442

OBLIQUITY MEAN 52.7368 DEG, STANDARD DEVIATION 18.8746 DEG

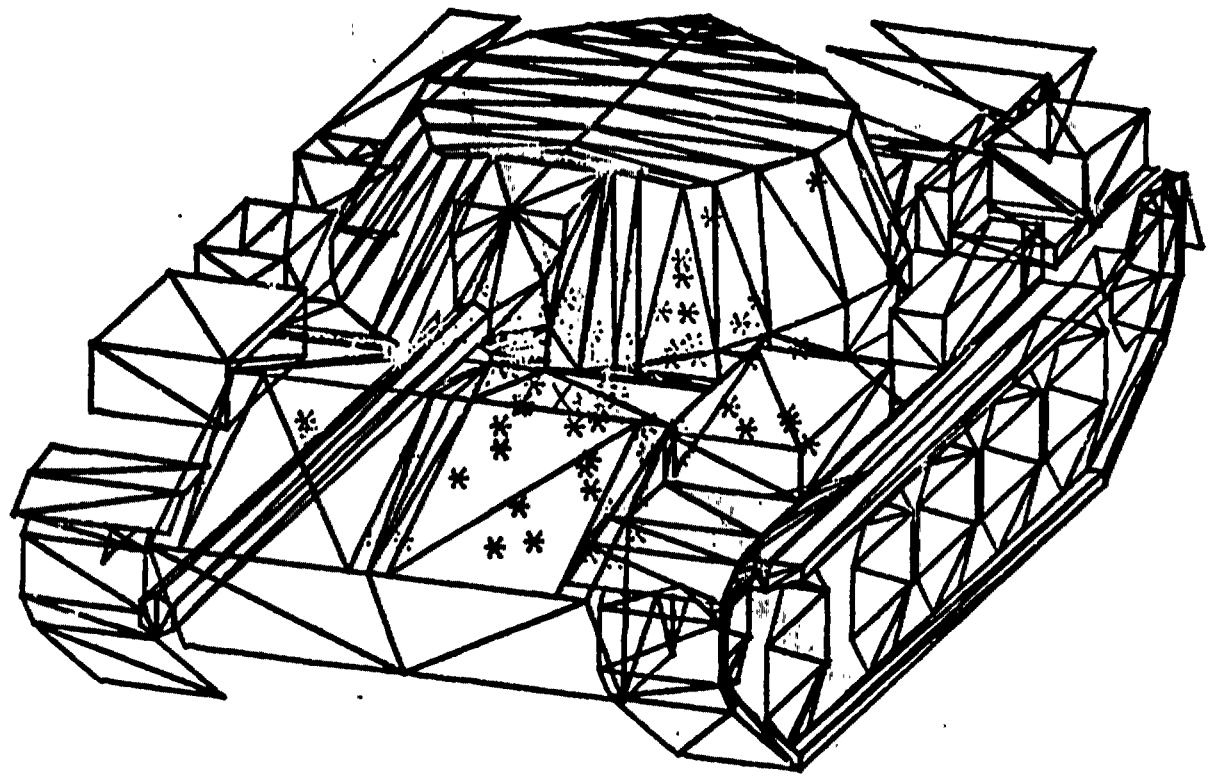
PERCENTILES:

RANK	DEVIATE
0.05	22.88
0.10	25.20
0.15	29.75
0.20	31.64
0.25	36.25
0.30	39.87
0.35	48.50
0.40	49.92
0.45	52.22
0.50	55.72
0.55	57.77
0.60	59.26
0.65	61.27
0.70	63.85
0.75	66.84
0.80	72.68
0.85	74.43
0.90	75.80
0.95	81.43

FACET NO.	NO. OF IMPACTS
136	11
231	8
242	7
178	6
135	4
-137	3
182	3
232	3
240	3
244	3
270	3
286	3
-280	2
-136	2
235	2
284	2
-231	1
-135	1
137	1
142	1
144	1
171	1
177	1
179	1
234	1
238	1
239	1
243	1
247	1
253	1
272	1
273	1
277	1
278	1
281	1
285	1


LOFAC COMPARISON WITH ZOT.14 RUN S10
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 71.1 PHI = 19.5
SCALE: X = -200 TO 100
Y = -100 TO 100



LOFRC COMPARISON WITH ZOT.14 RUN 510

THERE WERE 1 MISSES

THEY WERE REPS #: 54

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

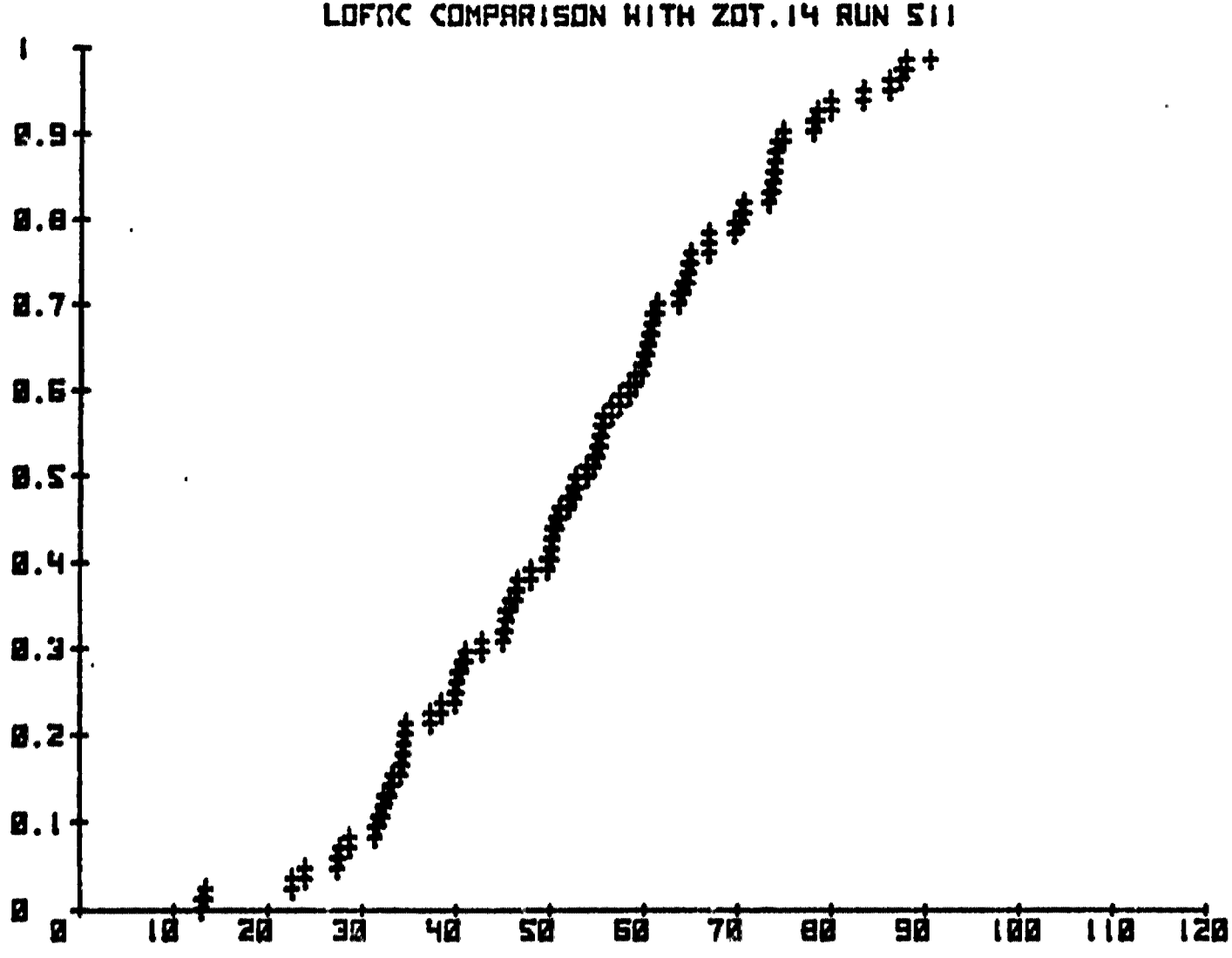
80	12.9474	43	34.7108	78	50.1607	60	59.0567	84	70.6296
37	13.4266	23	37.3086	56	50.2254	50	59.7143	75	73.3088
82	22.6000	14	38.4809	21	50.2399	72	59.9806	7	73.7126
36	23.9642	18	39.8595	58	50.6982	85	60.3299	66	73.8072
27	27.3679	22	40.0837	47	51.0494	44	60.5355	28	73.9880
8	27.8796	71	40.1264	32	51.9486	15	60.8570	2	74.0395
74	28.7323	83	40.5922	68	52.5346	52	60.8943	55	74.1839
63	31.3800	69	41.0614	45	52.7951	3	61.4051	26	74.8181
41	31.7416	16	42.7810	48	53.8709	57	63.7121	24	78.0189
39	32.2787	12	44.9687	65	54.6290	5	64.1324	4	78.4552
81	32.4097	64	45.2693	46	54.9984	51	64.6145	11	79.9013
62	33.0214	34	45.3094	30	55.3455	13	64.7058	20	83.3150
25	33.2916	17	45.7688	49	55.4357	73	64.9829	70	86.1450
42	34.1114	67	46.3392	40	55.6875	77	66.8963	6	87.286,
53	34.3468	79	46.6038	9	56.5291	35	66.9215	31	87.9006
59	34.1314	76	47.9651	61	57.3800	33	69.6313	29	90.4415
38	34.5247	19	49.7411	1	58.4106	10	70.3578		

OBLIQUITY MEAN 53.1648 DEG, STANDARD DEVIATION 17.7694 DEG

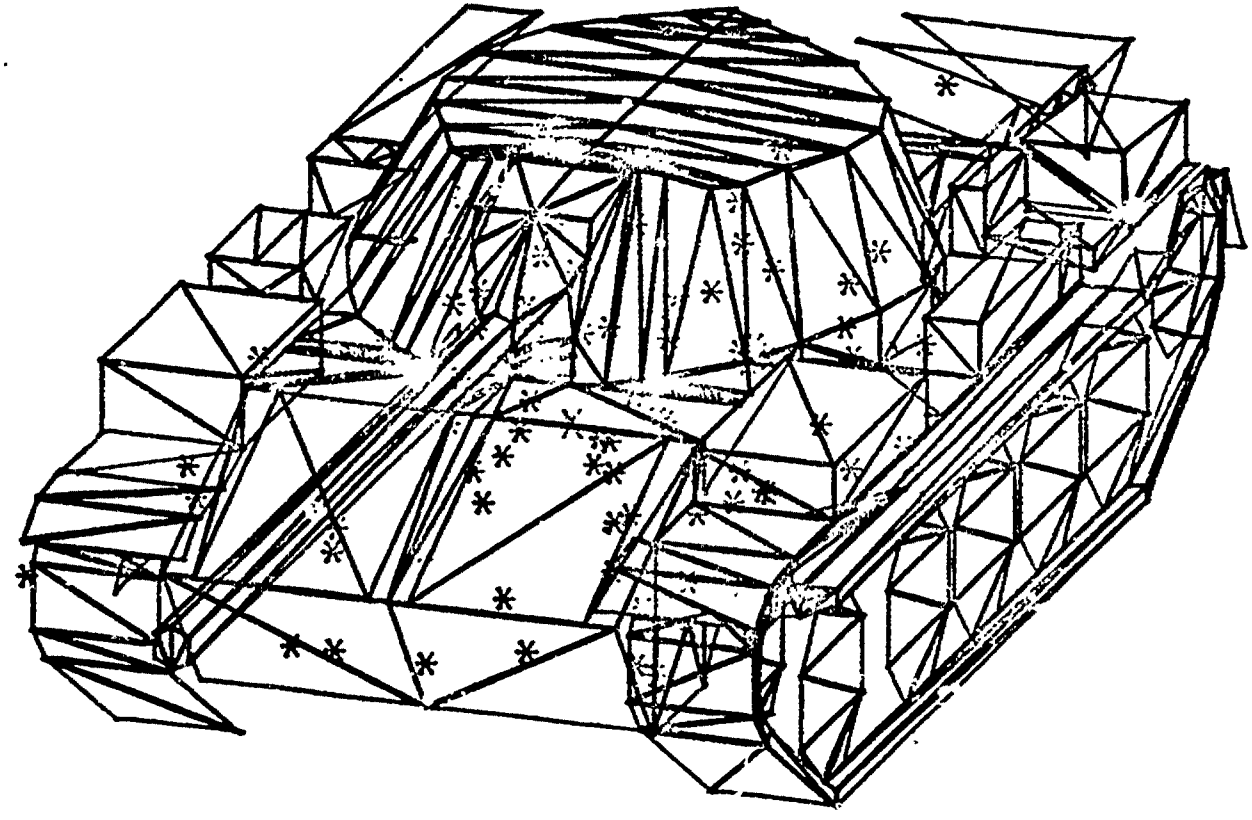
PERCENTILES:

RANK	DEVIATE
0.05	24.82
0.10	31.56
0.15	33.22
0.20	34.52
0.25	39.91
0.30	41.92
0.35	45.65
0.40	49.74
0.45	50.79
0.50	53.33
0.55	55.41
0.60	58.41
0.65	60.38
0.70	62.56
0.75	64.91
0.80	70.36
0.85	73.85
0.90	76.42
0.95	85.44

FACET NO.	NO. OF IMPACTS
136	9
182	6
242	4
231	3
-136	2
-134	2
44	2
134	2
142	2
144	2
236	2
244	2
245	2
281	2
-283	1
-270	1
-241	1
-240	1
-239	1
-238	1
-146	1
-144	1
-137	1
45	1
66	1
135	1
137	1
146	1
177	1
178	1
179	1
187	1
193	1
323	1
232	1
234	1
238	1
239	1
240	1
243	1
246	1
248	1
249	1
253	1
254	1
270	1
272	1
275	1
277	1
283	1
284	1
285	1
286	1
287	1
290	1
297	1


LOFTC COMPARISON WITH ZOT.14 RUN 511
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 71.1 PHI = 19.3
SCALE: X = -200 TO 100
Y = -100 TO 100



LOFAC COMPARISON WITH ZOT.14 RUN 511

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 512 PAGE 1

THERE WERE 5 MISSES

THEY WERE REPS #: 14 54 61 65 79

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

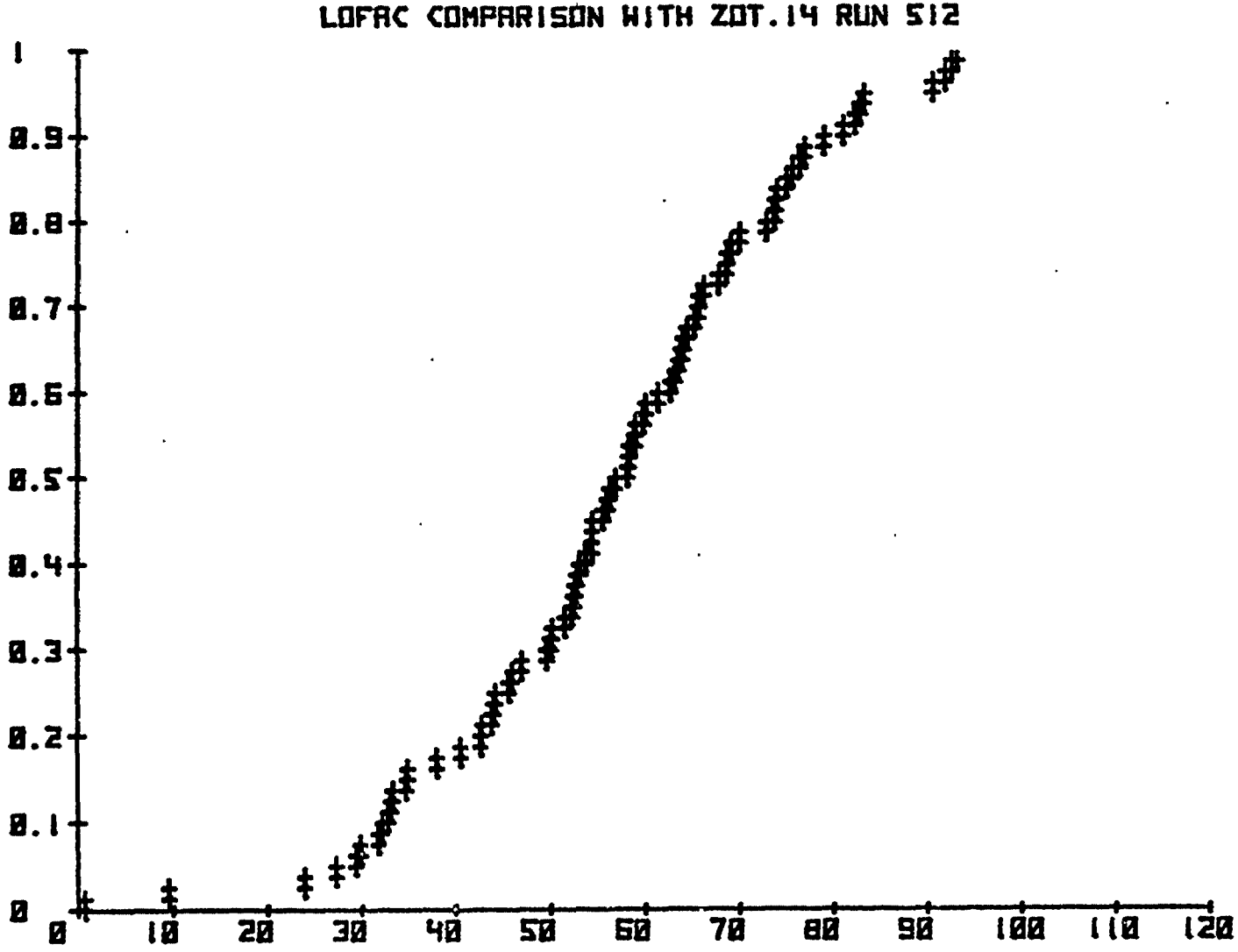
60	0.6876	77	43.8095	19	54.4862	12	63.9701	74	75.7764
37	9.5918	16	44.0345	10	54.5241	64	64.1646	38	76.5072
82	23.9524	83	44.1931	9	55.6608	71	64.5920	22	77.0592
8	27.3175	67	45.6253	33	56.1220	5	65.3639	31	79.0965
39	29.4133	35	46.0174	34	56.3756	59	65.7202	50	81.1888
27	29.9283	69	46.9750	52	56.9453	73	65.8490	49	82.3925
43	31.7968	21	49.6777	70	58.2158	32	66.3583	30	82.9619
76	32.2343	53	50.0967	41	58.3355	58	67.9239	15	83.3670
63	32.8418	20	50.2967	55	58.4314	13	68.6950	6	90.6650
24	33.1499	51	51.6128	2	59.0175	81	68.8065	29	92.0235
3	33.3513	80	52.3210	1	59.1052	68	69.2854	72	92.7290
42	34.7777	45	52.5679	47	59.9473	36	70.1596	56	93.2870
25	34.9939	11	52.7631	18	60.2035	65	72.9688		
23	38.0287	78	52.8788	48	61.5024	84	73.8519		
75	40.5760	40	53.1812	44	62.7960	28	73.9823		
62	42.6528	46	53.7884	85	63.2626	4	74.1379		
17	42.8093	7	54.4773	57	63.6457	26	75.1211		

OBLIQUITY MEAN 56.7366 DEG. STANDARD DEVIATION 18.4884 DEG

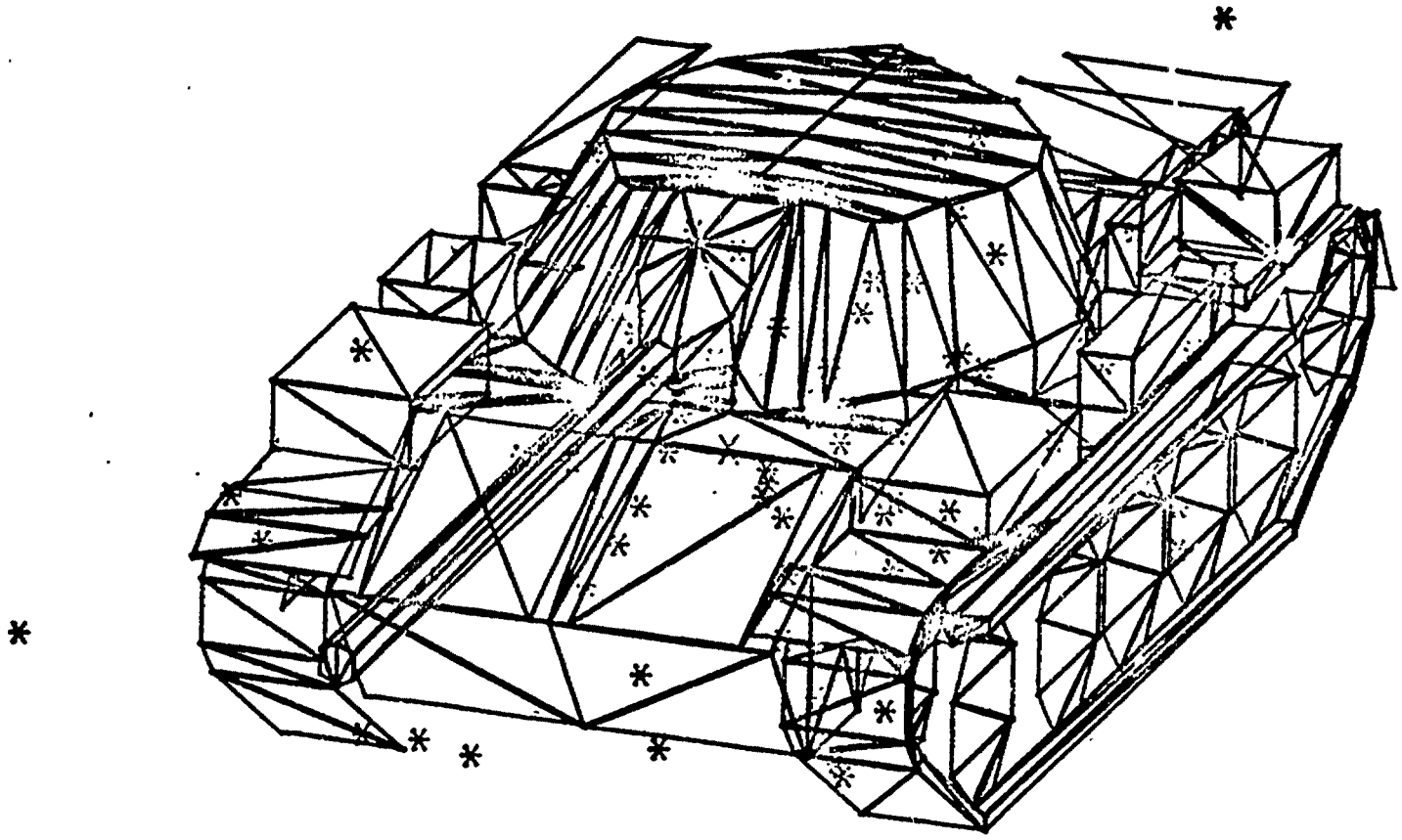
PERCENTILES:

RANK	DEVIATE
0.05	27.42
0.10	32.30
0.15	34.80
0.20	43.68
0.25	44.55
0.30	49.80
0.35	52.41
0.40	53.42
0.45	55.04
0.50	57.58
0.55	59.07
0.60	62.28
0.65	64.10
0.70	65.81
0.75	68.78
0.80	73.58
0.85	75.68
0.90	80.98
0.95	90.30

FACET NO.	NO. OF IMPACTS
136	8
45	3
146	3
182	3
242	3
287	3
-283	2
66	2
68	2
246	2
253	2
284	2
298	2
-294	1
-290	1
-286	1
-270	1
-247	1
-243	1
-239	1
-238	1
-236	1
-233	1
-144	1
-142	1
-68	1
65	1
106	1
108	1
111	1
118	1
134	1
137	1
144	1
177	1
178	1
179	1
183	1
184	1
193	1
219	1
222	1
231	1
232	1
234	1
235	1
238	1
243	1
245	1
247	1
248	1
270	1
281	1
286	1
290	1
294	1


LOFRC COMPARISON WITH ZOT.14 RUN 512
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 71.1 PHI = 19.3
SCALE: X = -200 TO 100
Y = -100 TO 100



LOFRC COMPARISON WITH ZOT.14 RUN 512

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 513 PAGE 1

THERE WERE 1 MISSES

THEY WERE REPS #: 4

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

35	8.6734	32	35.2859	15	57.3154	74	63.1035	9	71.6136
67	13.5100	5	40.7067	64	57.6134	38	64.1816	49	71.9164
27	15.2040	11	40.8205	71	58.1379	6	65.2877	69	72.0234
30	15.6465	79	41.4893	82	58.4645	17	66.5477	66	72.2869
33	16.5245	75	42.7675	51	58.6087	13	66.9586	70	72.8239
76	17.3298	53	50.5380	63	58.9309	12	67.2020	42	73.0249
59	18.3206	36	51.6294	14	59.2903	22	68.0316	3	73.9020
34	18.4346	72	51.8164	31	59.7934	41	68.6281	1	73.9336
45	20.5390	83	52.2733	77	59.9211	37	68.7373	16	74.0669
48	20.6404	44	52.4421	55	60.1519	52	69.1345	39	74.9727
47	21.9060	85	52.6220	18	60.2679	50	69.4914	2	76.6352
78	22.5937	61	53.5965	60	61.0834	84	69.6553	24	78.8291
21	23.7973	58	53.7346	73	61.9157	7	70.0955	43	78.9584
25	26.5823	54	53.9961	81	61.9549	26	70.4270	23	79.7724
65	30.2464	56	54.4212	68	62.6241	28	70.9657	29	79.8104
40	32.3357	62	55.4261	19	62.6755	8	71.3240	57	80.8555
20	34.7677	80	56.9798	46	62.7231	10	71.3615		

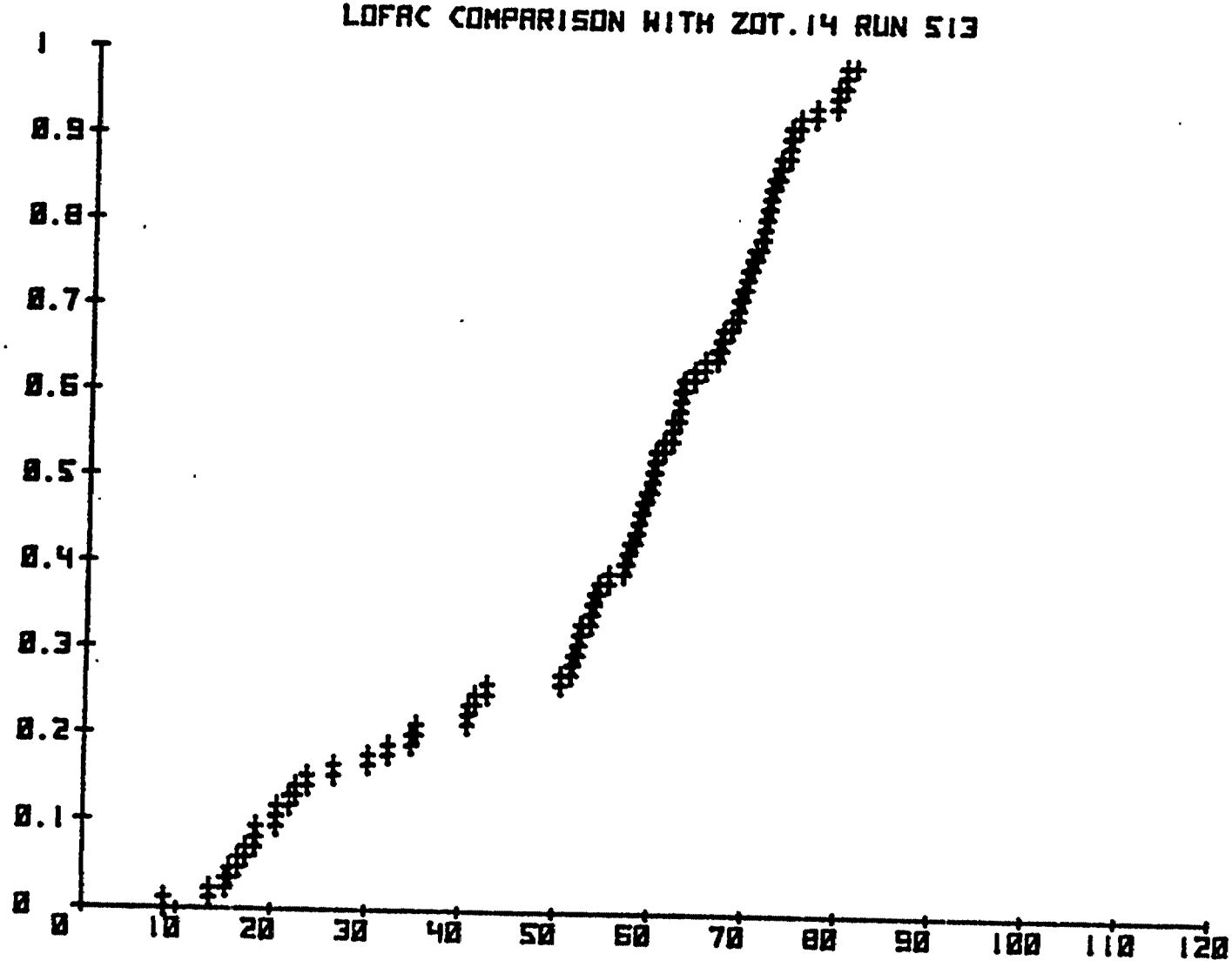
OBLIQUITY MEAN 54.5908 DEG. STANDARD DEVIATION 19.6263 DEG

PERCENTILES:

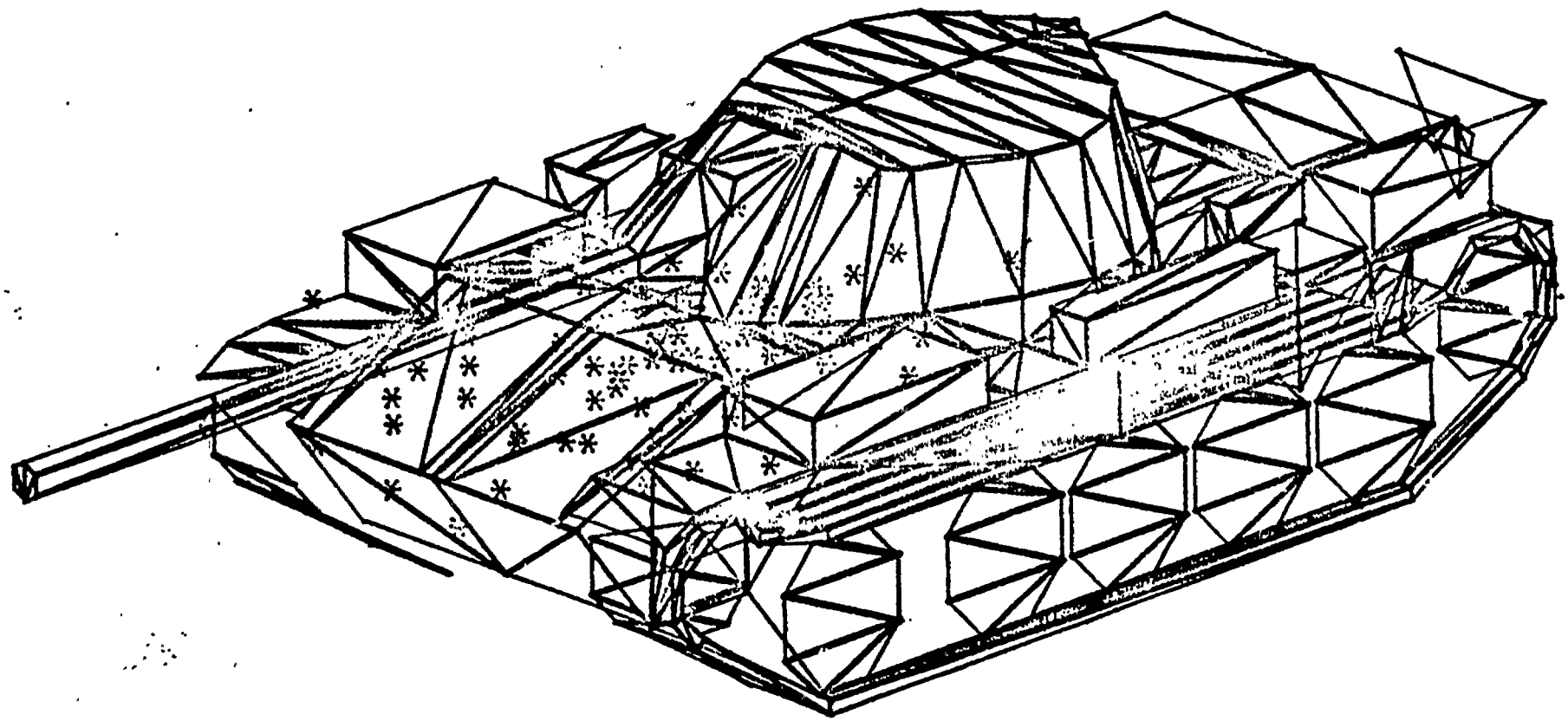
RANK	DEVIATE
0.05	15.87
0.10	19.49
0.15	23.50
0.20	34.77
0.25	41.81
0.30	52.04
0.35	53.70
0.40	56.98
0.45	58.50
0.50	59.86
0.55	61.71
0.60	62.72
0.65	66.65
0.70	68.68
0.75	69.99
0.80	71.36
0.85	72.42
0.90	74.00
0.95	78.93

LOFAC COMPARISON WITH ZOT.14 RUN 513

FACET NO.	NO. OF IMPACTS
136	14
231	10
287	6
-136	5
178	4
242	4
-134	3
146	3
-231	2
135	2
144	2
232	2
234	2
235	2
243	2
253	2
286	2
-236	1
-232	1
-137	1
171	1
179	1
182	1
233	1
238	1
240	1
241	1
245	1
248	1
270	1
274	1
275	1
284	1
294	1


LOFRC COMPARISON WITH ZOT.14 RUN 513
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 69.9 PHI = 46.5
SCALE: X = -270 TO 30
Y = -100 TO 100



LOFAC COMPARISON WITH ZOT.14 RUN 513

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 514 PAGE 1

THERE WERE 6 MISSES

THEY WERE REPS #: 4 14 54 60 72 73

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

43	8.1913	67	32.0234	85	53.7045	80	64.9399	5	74.7561
45	9.4811	94	32.1970	27	54.0177	19	65.3899	70	75.1640
76	13.3253	10	32.4046	64	54.2437	22	65.5630	31	76.3126
11	14.6118	41	33.2063	53	55.7535	75	65.6879	39	76.5060
30	16.8776	40	38.0022	62	55.8187	6	66.8796	2	77.5051
59	18.4988	79	40.8754	29	57.6291	37	67.2907	34	80.5466
33	19.0338	65	43.1023	32	57.9677	46	67.5093	24	81.2867
48	19.4226	3	44.9736	68	60.0920	7	67.5281	50	81.5092
78	22.4028	9	46.3261	71	60.3127	21	67.5499	23	82.7246
52	23.3308	36	48.6859	51	60.4805	26	69.1497	57	85.1277
47	23.4552	58	48.8515	63	60.7674	8	69.6078	66	86.4222
69	24.8463	81	50.0304	74	61.3666	13	70.0706		
35	25.3138	38	50.1849	18	61 [illegible]1	28	70.3614		
12	27.8088	56	50.5106	55	62. [illegible]6	20	72.9266		
15	29.8614	44	51.1674	82	62.7513	1	73.1683		
25	30.3737	61	52.1498	17	63.2617	42	73.9720		
49	31.7770	83	53.2124	77	63.9774	16	74.1788		

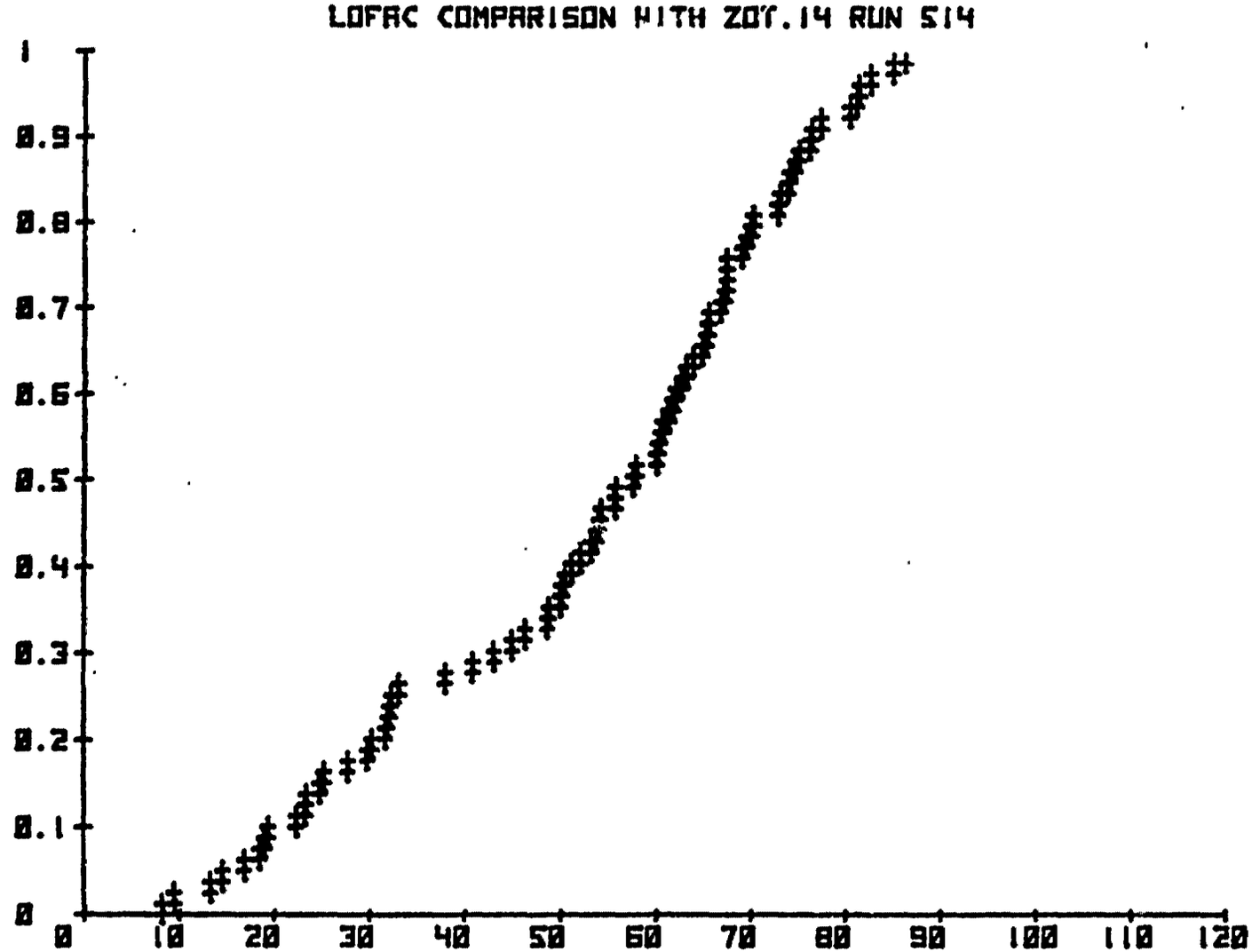
OBLIQUITY MEAN 52.6867 DEG, STANDARD DEVIATION 20.8162 DEG

PERCENTILES:

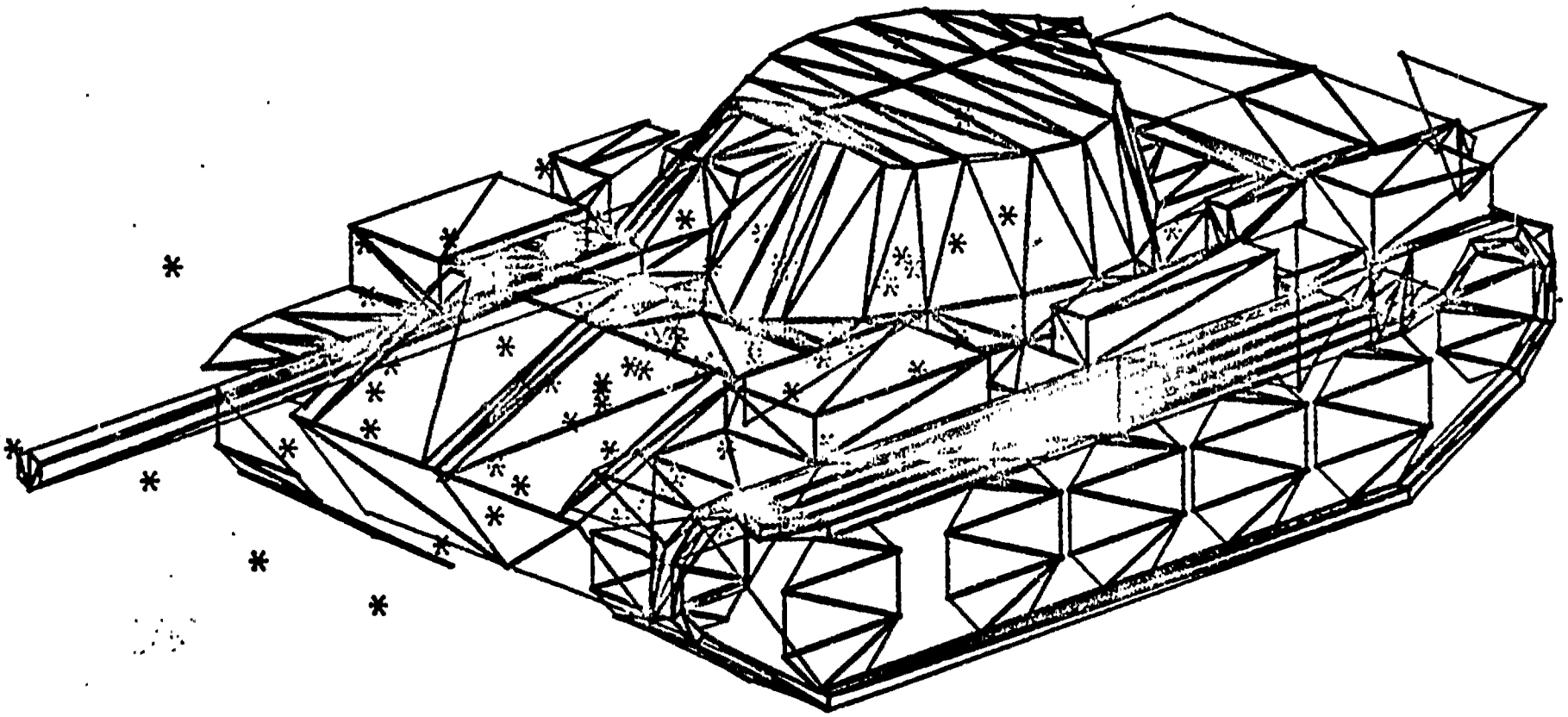
RANK	DEVIATE
0.05	14.61
0.10	19.42
0.15	24.85
0.20	30.37
0.25	32.40
0.30	43.10
0.35	48.85
0.40	51.17
0.45	54.02
0.50	57.63
0.55	60.48
0.60	62.13
0.65	64.94
0.70	66.88
0.75	67.55
0.80	70.36
0.85	74.18
0.90	76.51
0.95	81.51

LOFAC COMPARISON WITH ZOT.14 RUN 514

FACET NO.	NO. OF IMPACTS
136	11
231	8
-136	4
178	4
-232	3
144	2
197	2
234	2
244	2
245	2
253	2
270	2
286	2
-299	1
-236	1
-234	1
-146	1
-66	1
19	1
28	1
47	1
65	1
134	1
137	1
142	1
146	1
168	1
177	1
179	1
183	1
187	1
193	1
196	1
203	1
235	1
238	1
240	1
241	1
246	1
248	1
254	1
278	1
280	1
283	1
293	1
297	1


LOFRC COMPARISON WITH ZOT.14 RUN 514
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 69.9 PHI = 46.5
SCALE: X = -270 TO 30
Y = -100 TO 100



LOFAC COMPARISON WITH ZOT.14 RUN 514

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH 20T.14 RUN 515 PAGE 1

THERE WERE 1 MISSES

THEY WERE REPS #: 54

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

48	11.2846	24	33.4250	19	45.5966	35	59.8742	66	71.0648
43	15.1087	12	35.2919	64	46.2075	61	60.0340	33	71.3570
70	15.1880	83	35.7024	79	46.9443	16	60.8602	2	73.3267
53	19.5347	47	36.2361	17	47.8348	75	60.9095	28	73.8316
37	20.2063		36.9826	56	47.9169	10	61.2221	9	74.2329
82	20.3743	74	37.1581	84	49.4052	71	61.2967	26	75.1534
27	20.6227	34	37.2578	49	49.6400	85	61.9605	7	75.2151
41	24.0837	8	37.7373	22	50.6628	52	62.5985	18	76.2127
25	26.7575	80	38.6945	81	50.8456	15	62.6938	4	77.5378
42	27.2210	21	39.8555	58	53.3872	44	63.3639	11	79.1390
63	27.5397	78	40.8327	68	53.4895	1	63.4085	31	79.1781
36	28.7310	14	41.1025	65	55.1726	3	64.5859	60	79.8459
62	30.5815	39	41.4006	40	55.3398	77	64.6203	72	81.7720
23	31.3812	46	42.8045	45	55.3410	30	64.9372	20	85.1101
38	31.4061	32	43.0145	67	58.3636	73	65.4275	13	85.2028
76	31.7704	59	43.2151	55	58.5687	51	66.2779	6	87.4855
69	32.3111	29	44.5101	50	59.8643	5	67.1080		

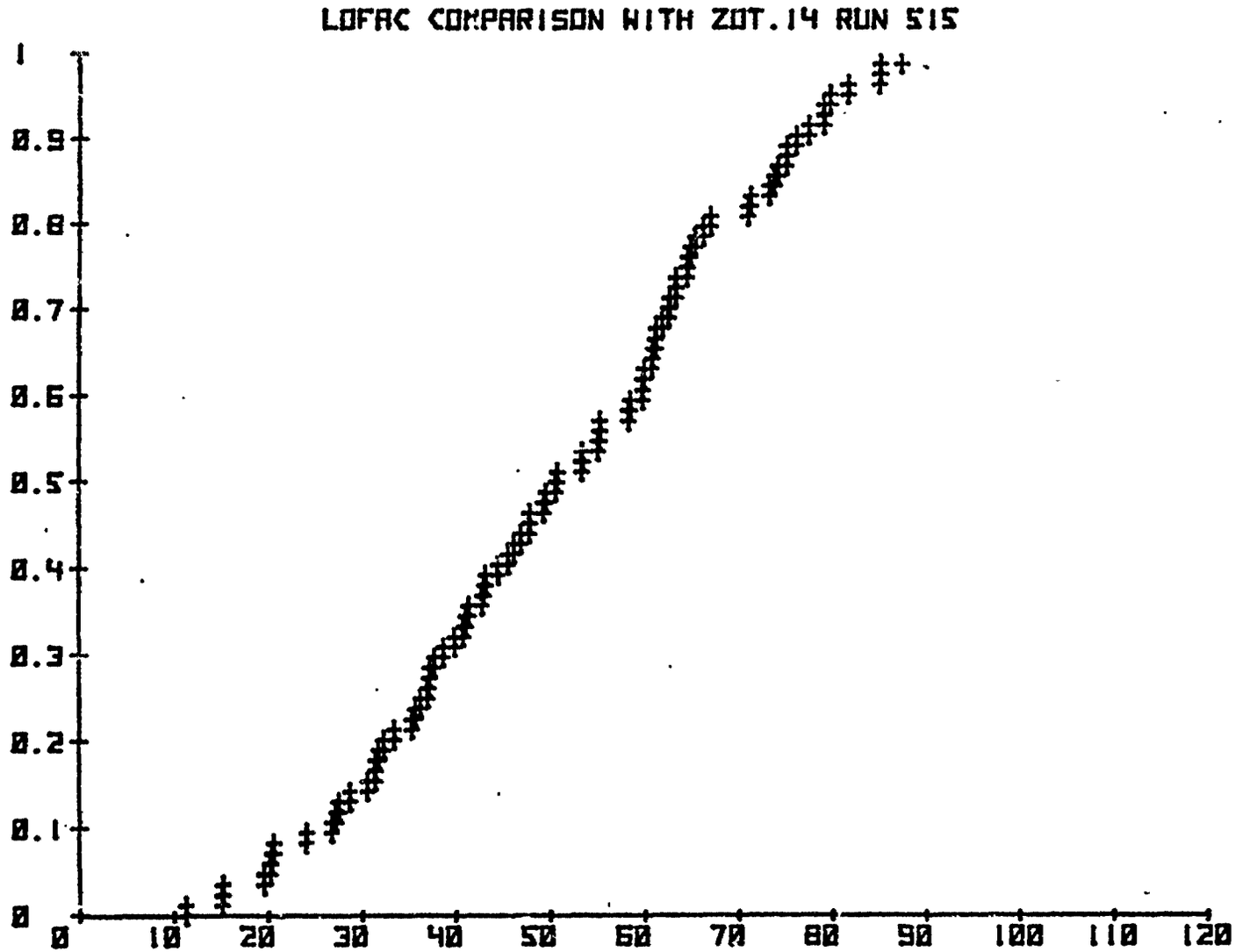
OBLIQUITY MEAN 50.9613 DEG, STANDARD DEVIATION 19.0542 DEG

PERCENTILES:

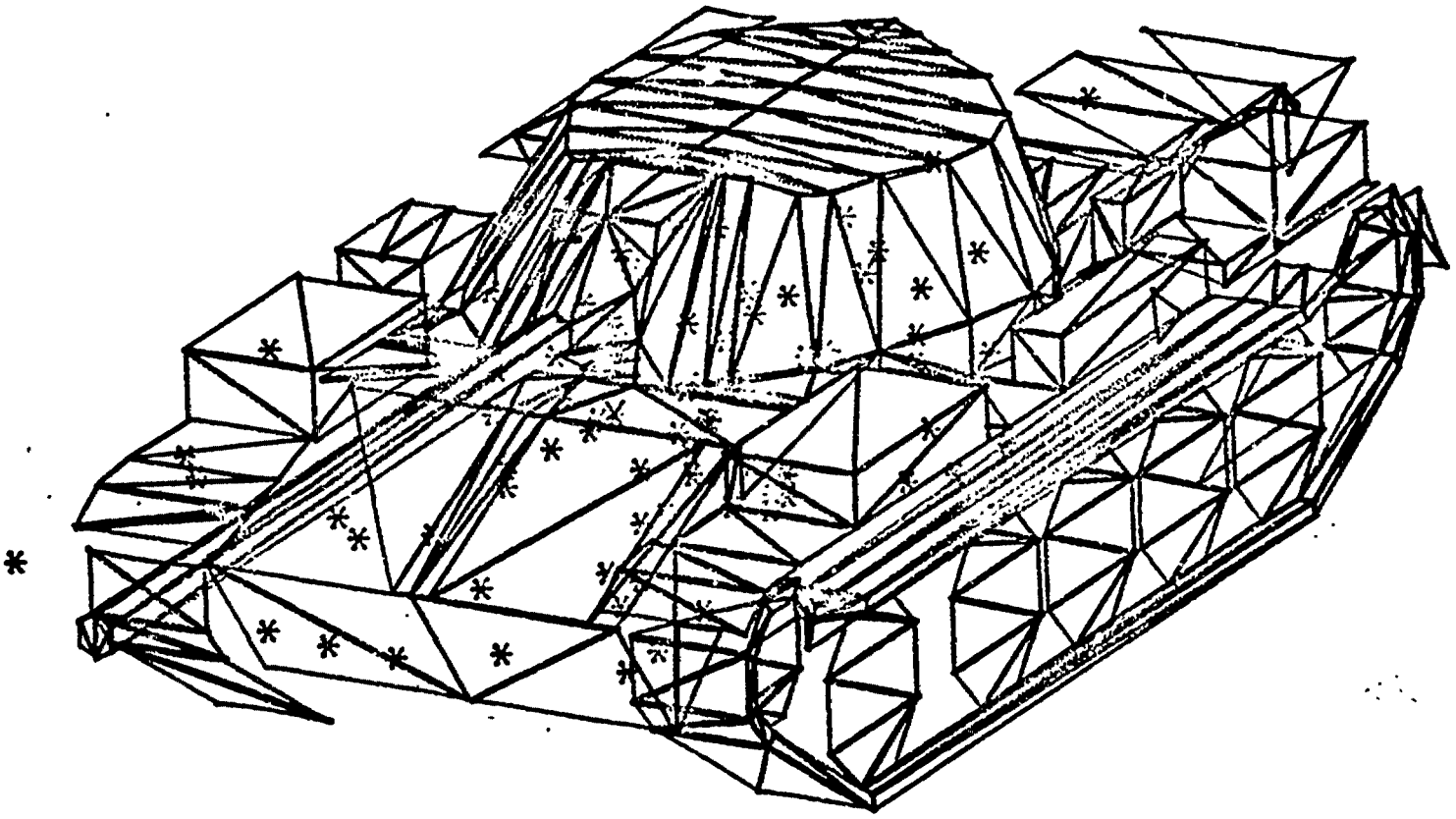
RANK	DEVIATE
0.05	19.70
0.10	25.42
0.15	30.12
0.20	32.31
0.25	36.42
0.30	38.22
0.35	41.33
0.40	44.51
0.45	47.86
0.50	50.75
0.55	55.30
0.60	59.86
0.65	60.99
0.70	62.65
0.75	64.61
0.80	67.11
0.85	73.93
0.90	76.88
0.95	81.29

LOFAC COMPARISON WITH ZOT.14 RUN 515

FACET NO.	NO. OF IMPACTS
136	6
182	6
135	4
231	4
242	4
-134	3
177	3
244	3
-242	2
-238	2
-137	2
-136	2
45	2
142	2
179	2
246	2
249	2
253	2
284	2
285	2
-271	1
-235	1
-231	1
-146	1
-144	1
44	1
66	1
134	1
187	1
193	1
223	1
232	1
234	1
236	1
238	
239	
240	
243	1
245	1
247	1
270	1
271	1
273	1
277	1
281	1
283	1
287	1


LOFRC COMPARISON WITH ZOT.14 RUN 515
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 71.1 PHI = 29.7
SCALE: X = -225 TO 75
Y = -100 TO 100



LOFAC COMPARISON WITH ZOT.14 RUN 515

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 516

THERE WERE 3 MISSES

THEY WERE REPS #: 24 63 67

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

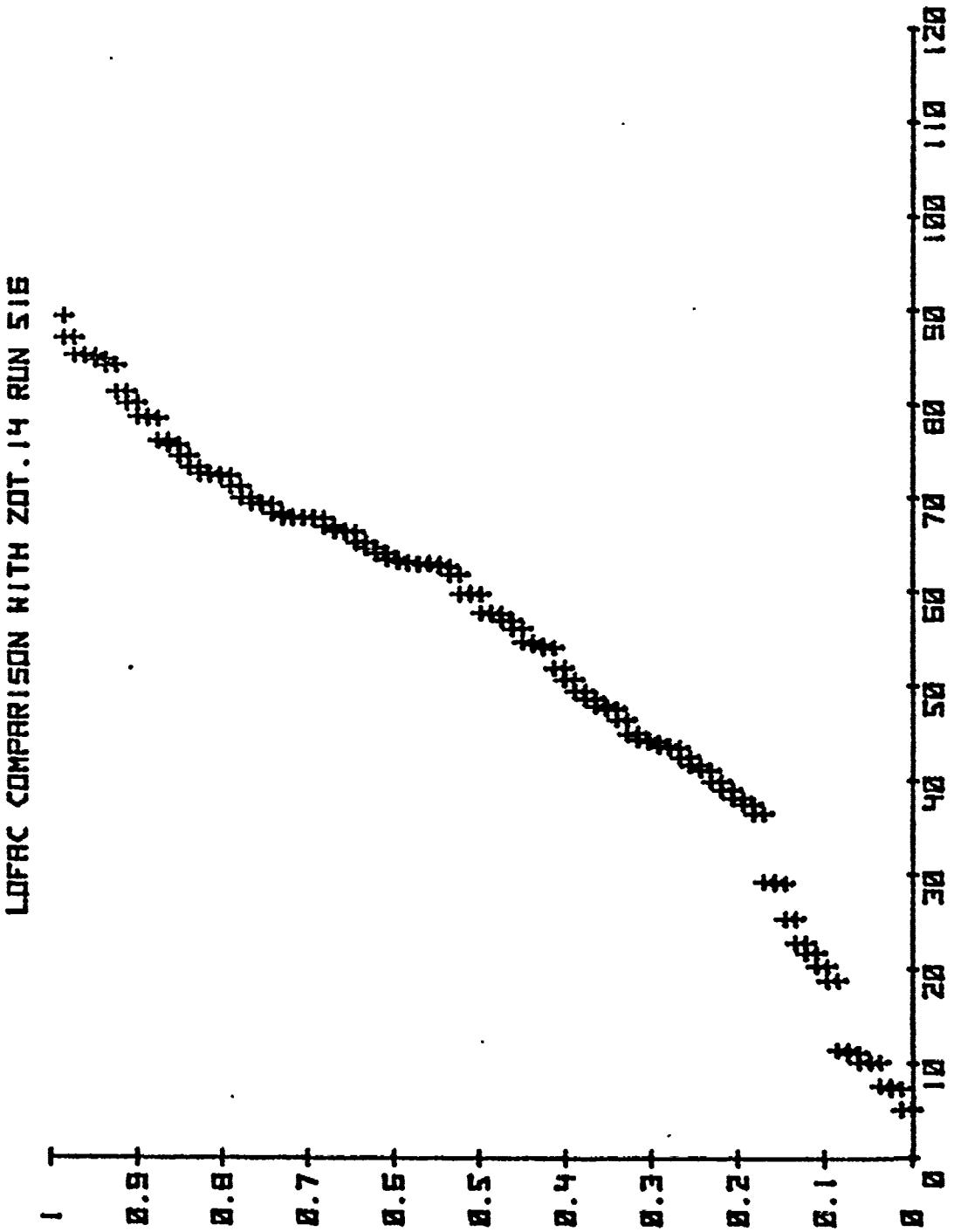
28	5.1392	76	39.0822	20	54.1252	57	64.7596	29	73.3677
37	7.3281	36	39.9509	44	54.4455	60	65.3324	55	74.5669
5	7.6808	43	41.1559	18	54.7391	25	66.4621	65	75.7452
6	10.1882	52	41.6608	49	56.1880	45	66.5625	84	76.2077
51	10.1940	82	42.5243	8	57.0286	33	67.0303	10	78.5565
72	11.1468	68	43.5271	19	57.7453	46	67.8953	79	78.7137
30	11.4596	53	43.6675	59	57.8295	21	67.9696	41	80.2339
50	18.8589	71	44.1276	23	59.8227	27	67.9932	69	81.3923
32	20.3669	16	44.3815	64	59.8409	2	68.0154	61	84.2948
81	21.7508	39	45.0364	14	61.8929	3	68.4331	74	84.8135
73	22.8130	58	46.5150	42	62.7280	77	69.4457	7	85.2394
66	25.3680	40	47.6424	31	63.0393	15	69.5635	34	85.3064
70	29.1728	38	47.9804	75	63.0671	4	70.1197	54	87.1388
85	29.3385	1	48.7911	48	63.0851	22	71.3384	13	89.4869
47	36.5573	17	49.5447	62	63.2607	80	72.4414		
26	37.5439	56	50.7639	9	63.6055	83	72.5826		
11	38.2020	78	52.0092	12	64.1854	35	72.6848		

OBLIQUITY MEAN 54.0454 DEG, STANDARD DEVIATION 21.7039 DEG

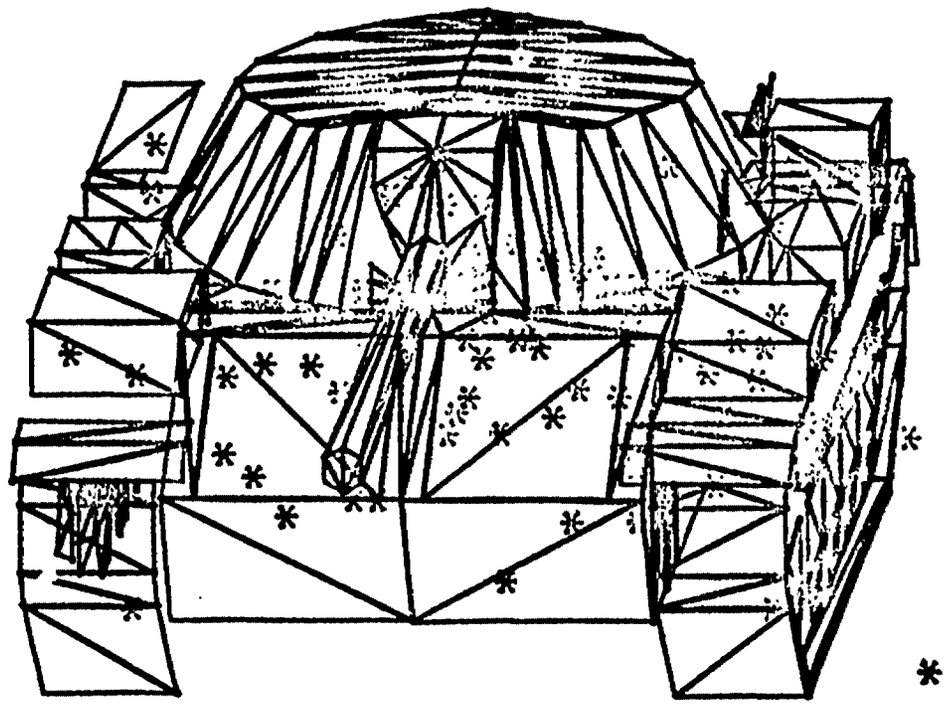
PERCENTILES:

RANK	DEVIATE
0.05	10.19
0.10	19.31
0.15	27.06
0.20	37.94
0.25	41.53
0.30	44.08
0.35	47.66
0.40	51.01
0.45	55.25
0.50	58.83
0.55	62.93
0.60	63.54
0.65	66.41
0.70	67.97
0.75	69.48
0.80	72.50
0.85	75.21
0.90	79.77
0.95	85.18

FACET NO.	NO. OF IMPACTS
136	10
-136	8
182	4
134	3
179	3
231	3
242	3
-286	2
-272	2
28	2
44	2
142	2
178	2
197	2
240	2
272	2
-242	1
-239	1
-238	1
-233	1
-137	1
-134	1
-68	1
67	1
91	1
135	1
146	1
192	1
207	1
212	1
227	1
228	1
235	1
238	1
239	1
241	1
244	1
246	1
248	1
253	1
270	1
277	1
278	1
283	1
284	1
285	1


LOFRC COMPARISON WITH ZOT.14 RUN 516
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 78.0 PHI = 5.1
SCALE: X = -160 TO 140
Y = -90 TO 110



LOFRC COMPARISON WITH ZOT.14 RUN 516

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 517 PAGE 1

THERE WERE 13 MISSES

THEY WERE REPS #: 4 7 10 24 26 29 40 45 50 55 63 65 67

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

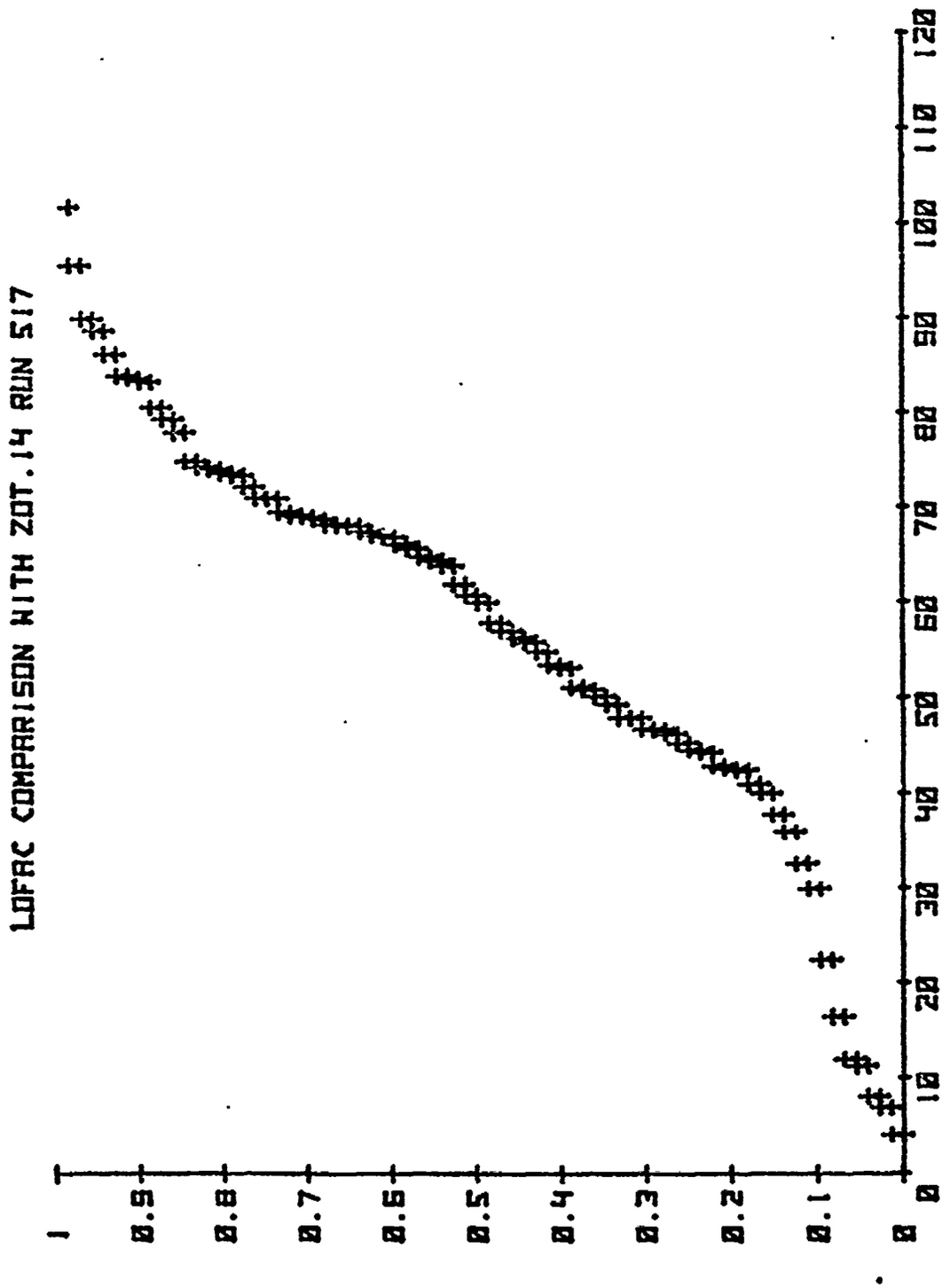
28	4.0838	52	44.5644	32	57.8630	81	69.1550	6	88.7427
59	6.9130	47	45.2677	51	59.9648	21	69.5320	22	89.9973
19	8.0693	83	46.2393	14	60.7581	70	71.0074	64	95.6740
46	11.2659	39	46.6766	53	61.8990	35	71.0140	25	101.8220
5	13.0210	82	46.7308	60	63.8607	20	72.2142		
73	16.4538	43	47.9038	8	64.4287	41	73.3958		
6.	22.4135	13	47.9070	36	64.7897	79	73.6691		
11	29.9488	15	49.3633	66	65.6838	18	74.0902		
85	32.6157	9	50.1769	12	66.1532	58	74.2650		
80	35.9294	78	50.8837	62	66.8912	69	74.8923		
17	37.7366	44	51.1378	49	67.0772	42	77.9422		
33	39.9823	23	53.1633	56	67.4859	74	79.3793		
68	40.9803	1	53.4589	54	68.0734	38	80.6236		
16	42.3989	72	54.8292	77	68.1691	84	83.3378		
31	42.5796	75	55.8091	27	68.2518	71	83.6963		
57	42.8632	30	56.2580	3	68.7697	48	83.9564		
76	44.2825	37	57.0082	2	69.0122	34	86.2306		

OBLIQUITY MEAN 57.1067 DEG, STANDARD DEVIATION 21.5366 DEG

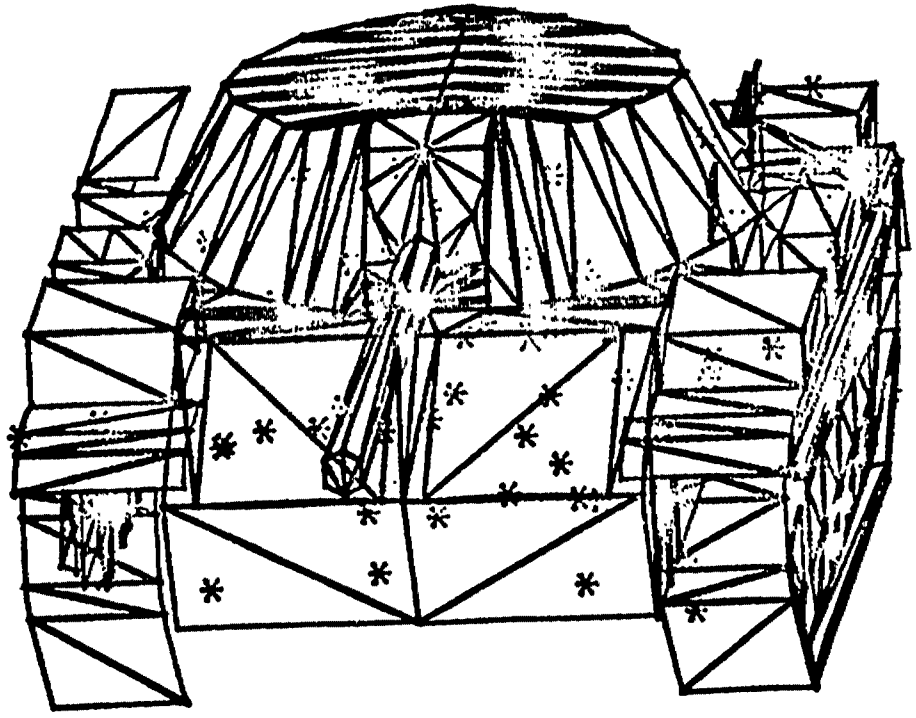
PERCENTILES:

RANK	DEVIATE
0.05	10.15
0.10	24.67
0.15	37.65
0.20	42.51
0.25	44.74
0.30	46.73
0.35	49.81
0.40	53.22
0.45	56.19
0.50	60.36
0.55	64.48
0.60	66.74
0.65	68.12
0.70	69.03
0.75	71.01
0.80	73.84
0.85	78.01
0.90	83.59
0.95	89.18

FACET NO.	NO. OF IMPACTS
136	8
231	6
-136	5
-134	3
182	3
-242	2
-146	2
44	2
134	2
242	2
287	2
-297	1
-281	1
-271	1
-246	1
-240	1
-238	1
-235	1
-212	1
-137	1
-133	1
-66	1
65	1
66	1
67	1
83	1
99	1
101	1
106	1
129	1
137	1
144	1
175	1
187	1
188	1
199	1
213	1
216	1
236	1
238	1
241	1
248	1
249	1
280	1
281	1
283	1


LOFRC COMPARISON WITH ZOT.14 RUN 517
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 78.0 PHI = 5.1
SCALE: X = -150 TO 140
Y = -90 TO 110



LOFAC COMPARISON WITH ZOT.14 RUN 517

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 518 PAGE 1

THERE WERE 17 MISSES

THEY WERE REPS #: 1 5 13 16 18 20 24 26 28 34 40 45 52 63 67 68 69

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

14	12.6962	74	48.0667	82	58.8490	80	71.6211
57	13.5475	56	48.3914	51	59.0862	76	72.6983
29	14.0715	36	48.4197	46	59.2550	17	75.4471
44	14.5925	21	48.9517	4	59.3642	65	76.7747
64	19.1442	42	49.2353	61	60.9175	35	79.3443
15	19.9502	10	49.3401	59	61.5050	49	81.3217
37	21.6109	84	49.5816	73	61.7321	81	81.4302
53	25.0462	3	51.3864	25	62.1950	2	83.6712
75	30.6345	11	53.3947	54	64.2208	22	83.8683
72	35.8365	71	55.0897	48	66.6428	60	84.1484
78	37.4760	83	56.0629	27	66.7408	12	85.7941
39	42.1226	31	56.7022	55	66.8186	50	87.0542
85	42.3677	79	56.8072	9	67.6780	41	88.0620
33	43.3539	62	57.9892	30	68.4674	19	88.6653
58	44.0240	32	58.2572	6	69.6349	8	88.7758
77	46.2096	70	58.4266	23	70.5305	7	92.1715
43	46.9883	47	58.7266	38	71.0867	66	92.8704

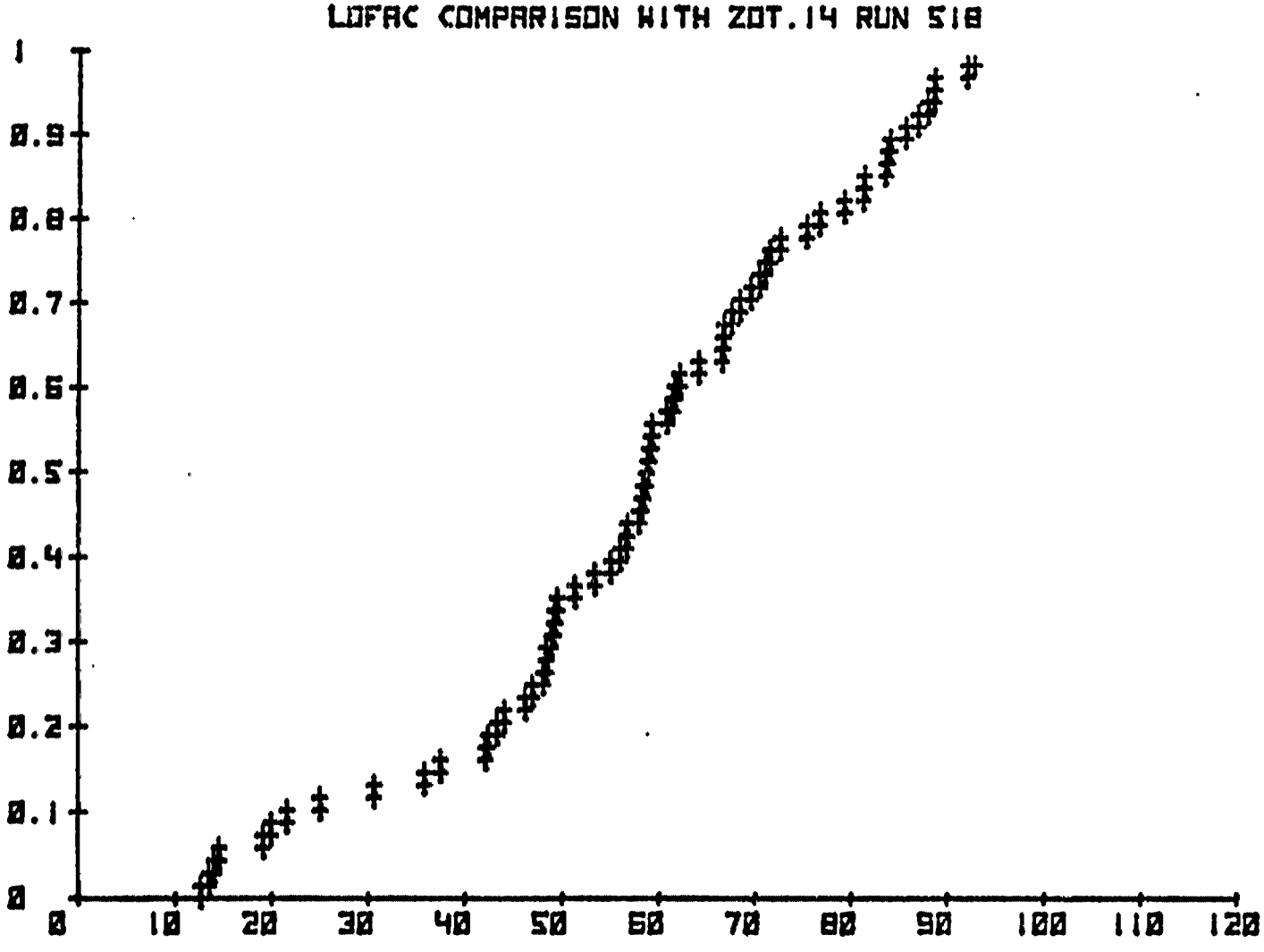
OBLIQUITY MEAN 57.6904 DEG, STANDARD DEVIATION 20.8414 DEG

PERCENTILES:

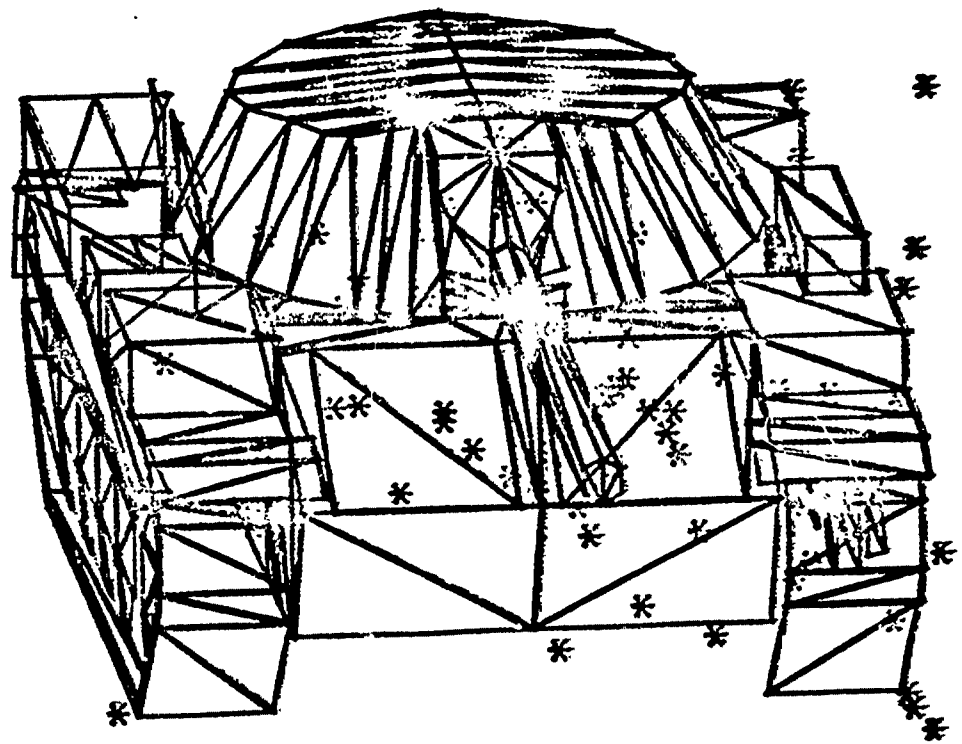
RANK	DEVIATE
0.05	14.31
0.10	21.44
0.15	36.41
0.20	43.16
0.25	47.26
0.30	48.79
0.35	49.85
0.40	55.67
0.45	58.00
0.50	58.79
0.55	59.36
0.60	61.92
0.65	66.73
0.70	68.82
0.75	71.49
0.80	77.29
0.85	82.89
0.90	85.92
0.95	88.73

LOFAC COMPARISON WITH ZOT.14 RUN 518

FACET NO.	NO. OF IMPACTS
136	9
-136	7
134	4
231	3
-286	2
-270	2
-242	2
-137	2
66	2
144	2
146	2
241	2
-290	1
-287	1
-284	1
-280	1
-273	1
-245	1
-241	1
-240	1
-234	1
-144	1
-66	1
-65	1
67	1
68	1
123	1
154	1
170	1
182	1
186	1
188	1
192	1
197	1
234	1
247	1
248	1
280	1
283	1
286	1
290	1


LOFRC COMPARISON WITH ZOT.14 RUN 518
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 77.8 PHI = -5.4
SCALE: X = -160 TO 140
Y = -90 TO 110



LOFAC COMPARISON WITH ZOT.14 RUN 518

THERE WERE 3 MISSES

THEY WERE REPS #: 35 45 50

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

46	0.9494	26	41.2211	15	53.7957	54	68.6391	20	79.3216
6	5.7634	43	41.4478	64	54.2162	27	68.7506	69	82.0270
13	22.8922	19	41.8482	61	57.3642	23	68.9230	12	82.2268
30	25.8918	33	44.0716	40	60.3047	67	69.5935	21	82.3554
32	28.4375	16	44.2340	18	60.7383	47	70.0317	74	82.5052
56	31.0401	71	44.2743	42	62.0527	9	70.4051	4	82.5732
55	31.2114	58	44.4722	75	63.0918	37	70.8871	34	84.0011
49	31.8659	38	44.5578	85	63.2235	77	71.4307	14	84.2844
72	32.8233	51	44.9101	59	64.7513	79	74.4488	28	84.4060
17	33.6720	1	47.7422	82	64.7803	53	75.5046	81	85.1435
41	34.4218	52	49.0560	31	65.4898	39	76.0520	3	85.5994
76	35.3882	25	51.5278	48	65.7749	5	76.4923	63	89.2435
66	36.0588	68	52.4410	60	66.1348	8	77.4535	22	89.9298
62	37.1655	24	52.7064	70	66.8144	24	77.9143	7	91.2411
73	39.9588	44	52.9417	57	67.0330	80	78.0044		
11	40.1608	36	53.0837	2	67.5007	65	78.3823		
78	40.9796	83	53.0954	10	68.5062	29	78.8674		

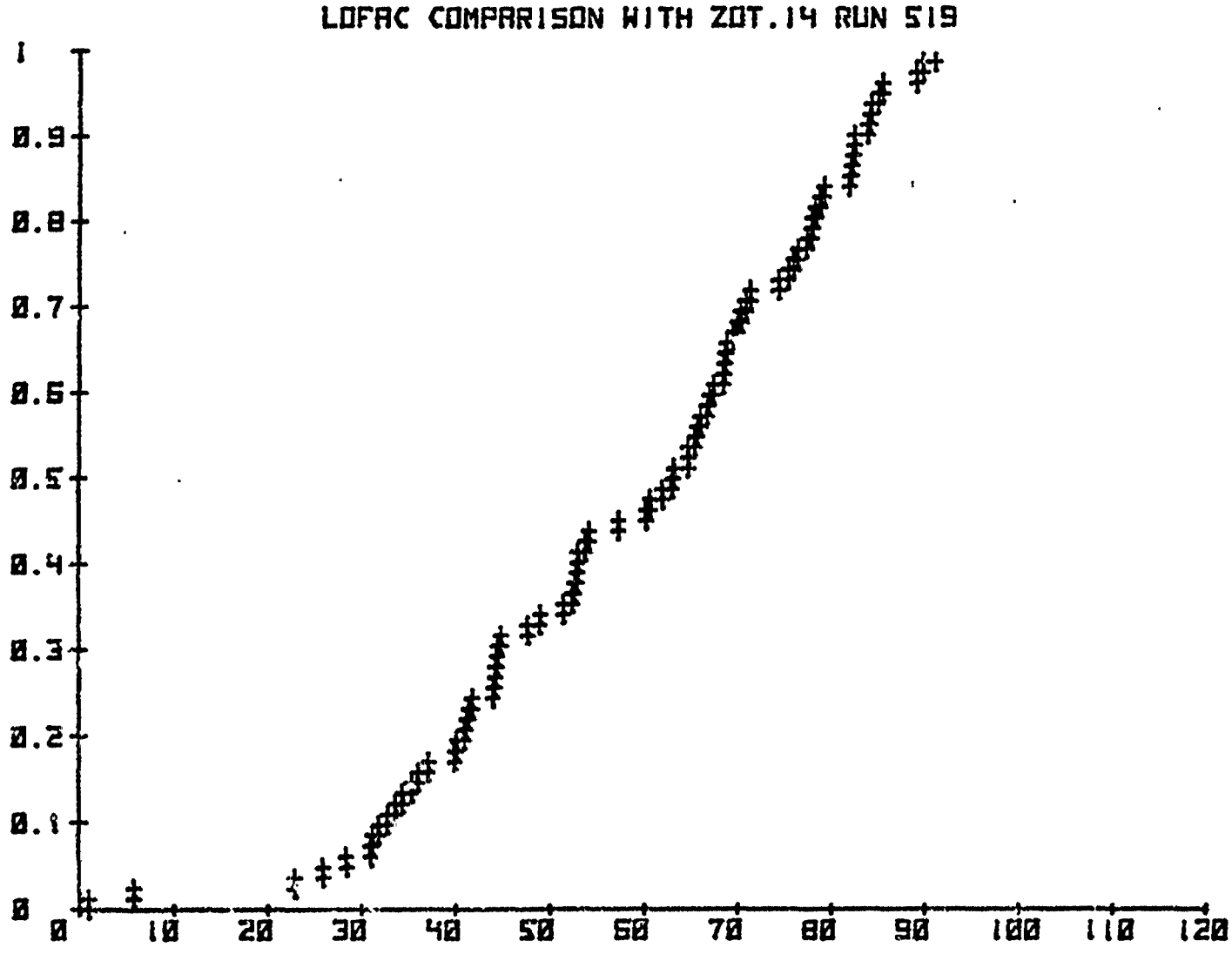
OBLIQUITY MEAN 58.7868 DEG, STANDARD DEVIATION 20.1383 DEG

PERCENTILES:

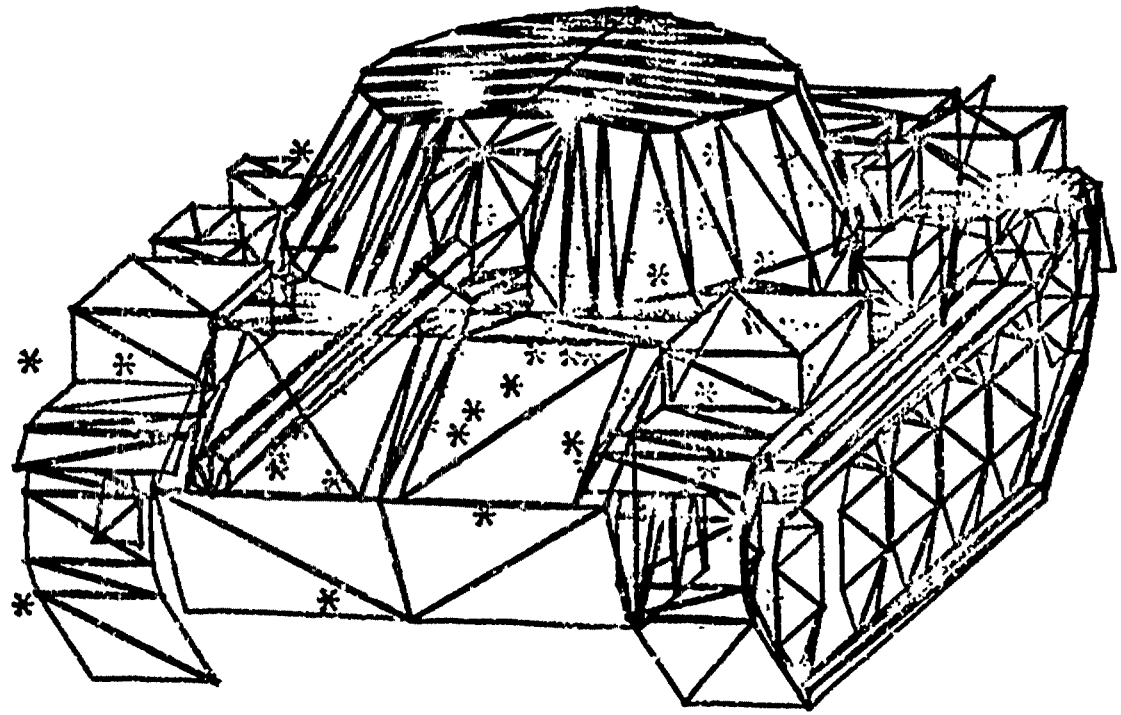
RANK	DEVIATE
0.05	26.27
0.10	32.15
0.15	35.69
0.20	40.65
0.25	43.52
0.30	44.55
0.35	51.57
0.40	53.09
0.45	58.39
0.50	63.16
0.55	65.68
0.60	67.41
0.65	68.91
0.70	70.94
0.75	76.16
0.80	78.16
0.85	82.14
0.90	83.57
0.95	85.53

LOFAC COMPARISON WITH ZOT.14 RUN 519

FACET NO.	NO. OF IMPACTS
136	9
-136	6
178	6
287	5
238	4
45	3
137	3
222	2
241	2
242	2
248	2
-290	1
-289	1
-271	1
-142	1
-134	1
28	1
35	1
44	1
64	1
65	1
66	1
97	1
122	1
134	1
135	1
142	1
144	1
156	1
177	1
179	1
182	1
187	1
196	1
197	1
199	1
231	1
233	1
235	1
239	1
240	1
244	1
245	1
246	1
247	1
270	1
283	1
284	1
286	1


LOFAC COMPARISON WITH ZOT.14 RUN 519
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 78.0 PHI = 15.4
SCALE: X = -200 TO 100
Y = -80 TO 120



LOFRC COMPARISON WITH ZOT.14 RUN 519

LOFAC COMPARISON WITH 20T.14 RUN 520 PAGE 1

THERE WERE 10 MISSES

THEY WERE REPS #: 1 24 26 40 43 45 50 64 67 85

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

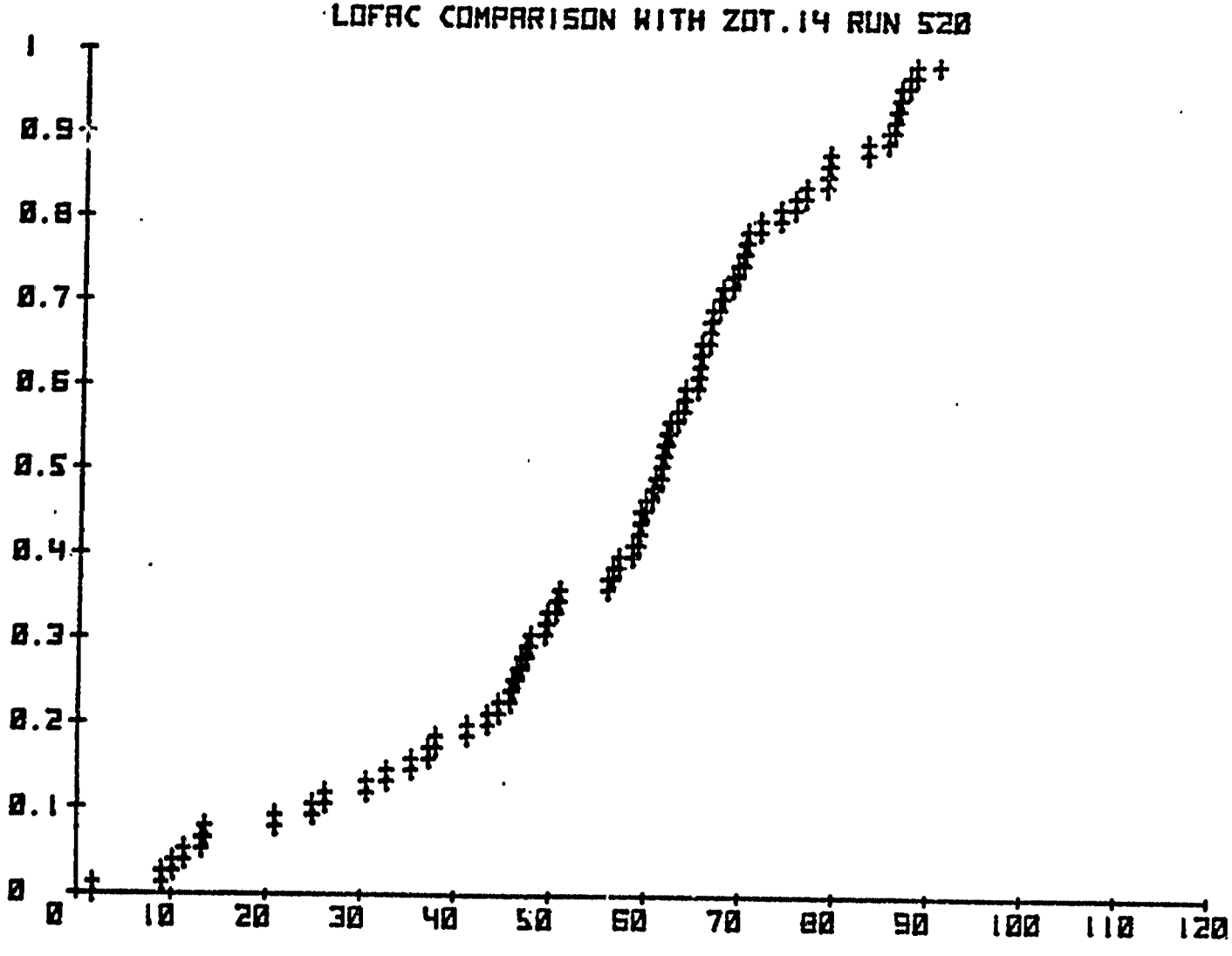
46	1.7055	82	45.7659	23	59.7848	61	66.6376	37	85.7259
28	8.9917	72	46.0322	70	60.4285	2	67.3800	34	85.8880
19	10.1694	83	46.4991	52	60.8579	66	67.7252	3	86.2589
48	11.3363	80	46.9313	65	61.4072	77	68.7286	35	86.4547
5	13.1756	44	47.4667	62	61.5023	41	69.2781	18	87.3193
25	13.5232	20	47.8679	81	61.6631	51	69.8316	63	88.0124
14	20.9486	42	49.4029	55	61.9512	11	70.0590	22	90.4623
73	24.9225	27	49.6624	33	62.2620	79	70.2955		
47	26.2601	12	50.5081	75	63.0713	68	71.6009		
56	30.6344	15	50.8555	53	63.6818	74	73.7498		
8	32.7380	39	55.9169	49	63.8654	29	75.3050		
78	35.3189	54	56.4619	13	65.1430	38	76.3702		
17	37.1868	84	57.0240	60	65.3514	10	78.6174		
76	37.9217	6	58.4747	30	65.3588	7	78.7401		
16	41.2459	4	59.0491	57	65.5221	21	78.9091		
59	43.4164	31	59.2382	58	66.3896	71	82.9758		
9	44.5768	69	59.2877	36	66.3918	32	85.1201		

OBLIQUITY MEAN 56.7546 DEG, STANDARD DEVIATION 21.1113 DEG

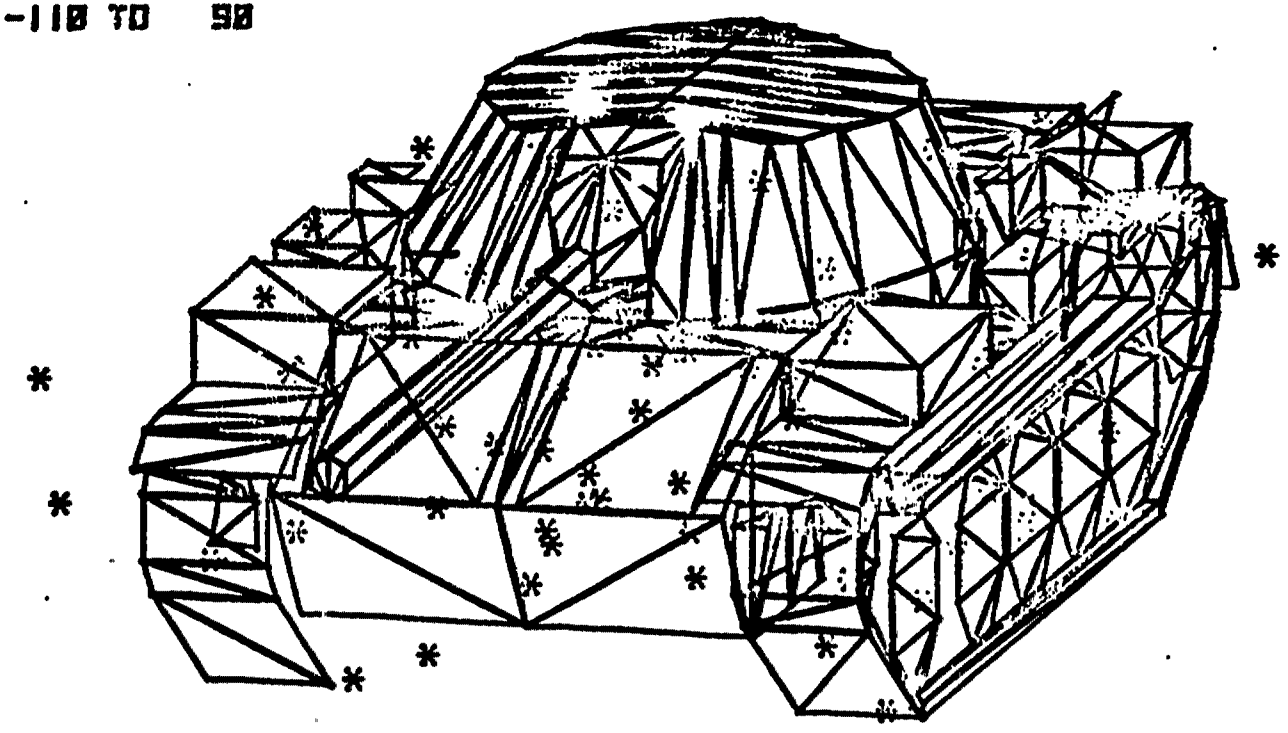
PERCENTILES:

RANK	DEVIATE
0.05	11.10
0.10	23.33
0.15	33.77
0.20	41.68
0.25	46.03
0.30	47.79
0.35	50.72
0.40	57.60
0.45	59.39
0.50	61.41
0.55	62.20
0.60	64.63
0.65	65.87
0.70	67.45
0.75	69.83
0.80	73.32
0.85	78.69
0.90	85.36
0.95	88.63

FACIT NO.	NO. OF IMPACTS
136	7
134	5
182	4
-136	3
137	3
231	3
-238	2
-231	2
44	2
68	2
115	2
178	2
232	2
241	2
-298	1
-294	1
-242	1
-234	1
-134	1
-66	1
65	1
66	1
82	1
85	1
91	1
97	1
101	1
122	1
125	1
129	1
156	1
168	1
179	1
183	1
193	1
197	1
198	1
218	1
223	1
236	1
238	1
240	1
244	1
249	1
250	1
271	1
283	1
287	1


LOFAC COMPARISON WITH ZOT.14 RUN 520
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 78.0 PHI = 15.4
SCALE: X = -200 TO 100
Y = -110 TO 90



LOFAC COMPARISON WITH ZOT.14 RUN 520

LOFAC COMPARISON WITH ZOT.14 RUN 521 PAGE 1

THERE WERE 14 MISSES

THEY WERE REPS #: 1 5 7 13 24 26 34 40 45 50 61 63 64 67

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

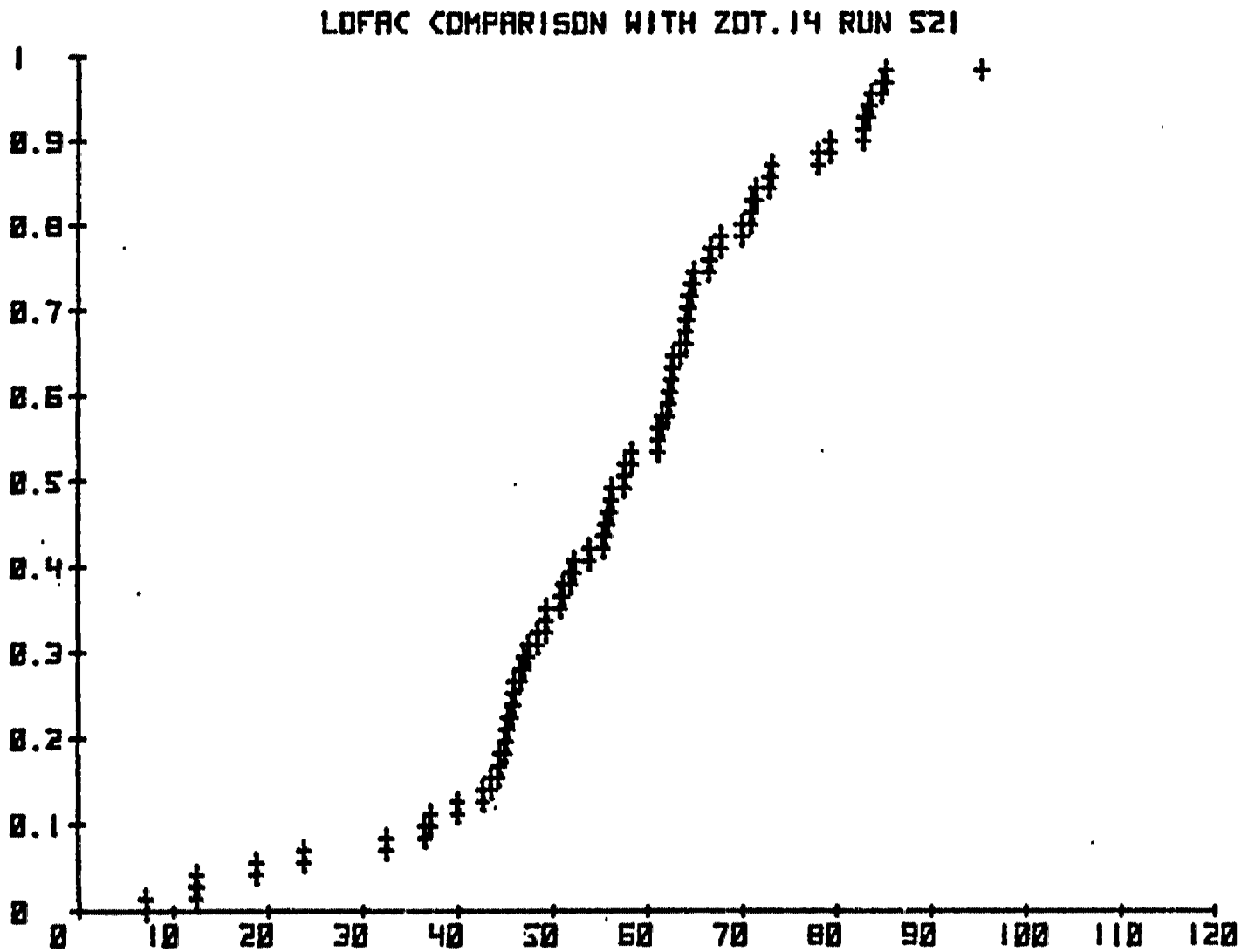
57	7.1190	51	45.8871	49	56.2510	58	64.6971	74	84.9623
60	12.4565	47	45.9782	3	57.6008	76	64.9885	6	85.3960
8	12.5375	17	46.6351	82	57.6771	2	66.5898	80	95.5433
14	18.8275	38	47.0190	78	58.3473	62	66.7558		
15	23.8456	11	47.5087	31	61.1377	27	67.8523		
39	32.5549	52	48.4853	66	61.1619	19	70.0988		
72	36.6012	43	49.3682	32	61.5890	28	71.0687		
9	37.2078	48	49.3931	69	62.1960	23	71.1610		
36	40.0563	79	50.8734	44	62.3052	22	71.6243		
55	42.6725	68	51.1676	12	62.5471	29	73.0114		
71	43.5304	25	51.9547	30	62.6881	18	73.2685		
56	44.3180	37	52.3124	35	62.7955	16	78.1633		
75	44.4755	59	53.9190	42	63.5427	4	79.4598		
46	45.0148	65	55.4063	53	64.1101	10	83.0236		
77	45.1725	21	55.5851	70	64.1219	41	83.0620		
73	45.2956	33	55.8307	85	64.3080	81	83.5480		
83	45.7226	84	56.1531	54	64.4260	20	83.8579		

OBLIQUITY MEAN 56.4200 DEG, STANDARD DEVIATION 17.6461 DEG

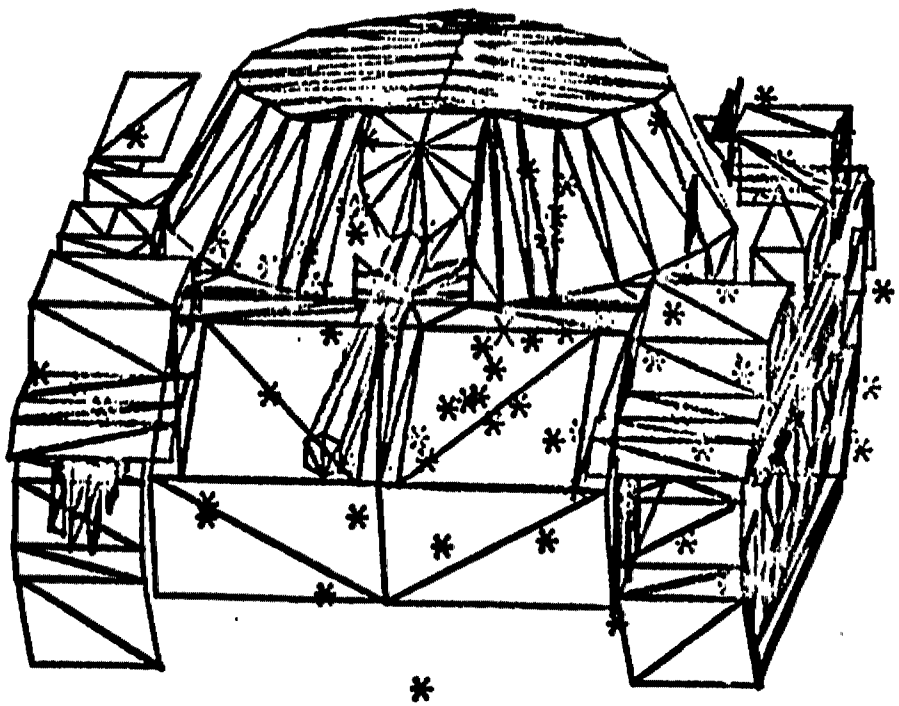
PERCENTILES:

RANK	DEVIATE
0.05	16.31
0.10	36.72
0.15	43.36
0.20	45.08
0.25	45.89
0.30	47.31
0.35	49.69
0.40	52 24
0.45	55.60
0.50	57.60
0.55	61.15
0.60	62.35
0.65	63.39
0.70	64.36
0.75	66.59
0.80	70.68
0.85	73.06
0.90	82.31
0.95	84.30

FACET NO.	NO. OF IMPACTS
136	12
-238	5
-134	4
-136	3
242	3
83	2
134	2
135	2
178	2
179	2
182	2
231	2
241	2
-290	1
-244	1
-243	1
-242	1
-239	1
-231	1
-146	1
-144	1
28	1
44	1
66	1
67	1
68	1
127	1
129	1
137	1
142	1
146	1
189	1
192	1
197	1
207	1
213	1
248	1
253	1
283	1
286	1
287	1


LOFAC COMPARISON WITH ZOT.14 RUN 521
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 77.8 PHI = 5.3
SCALE: X = -160 TO 140
Y = -90 TO 110



LOFAC COMPARISON WITH ZOT.14 RUN 521

THERE WERE 0 MISSES

THEY WERE REPS #:

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

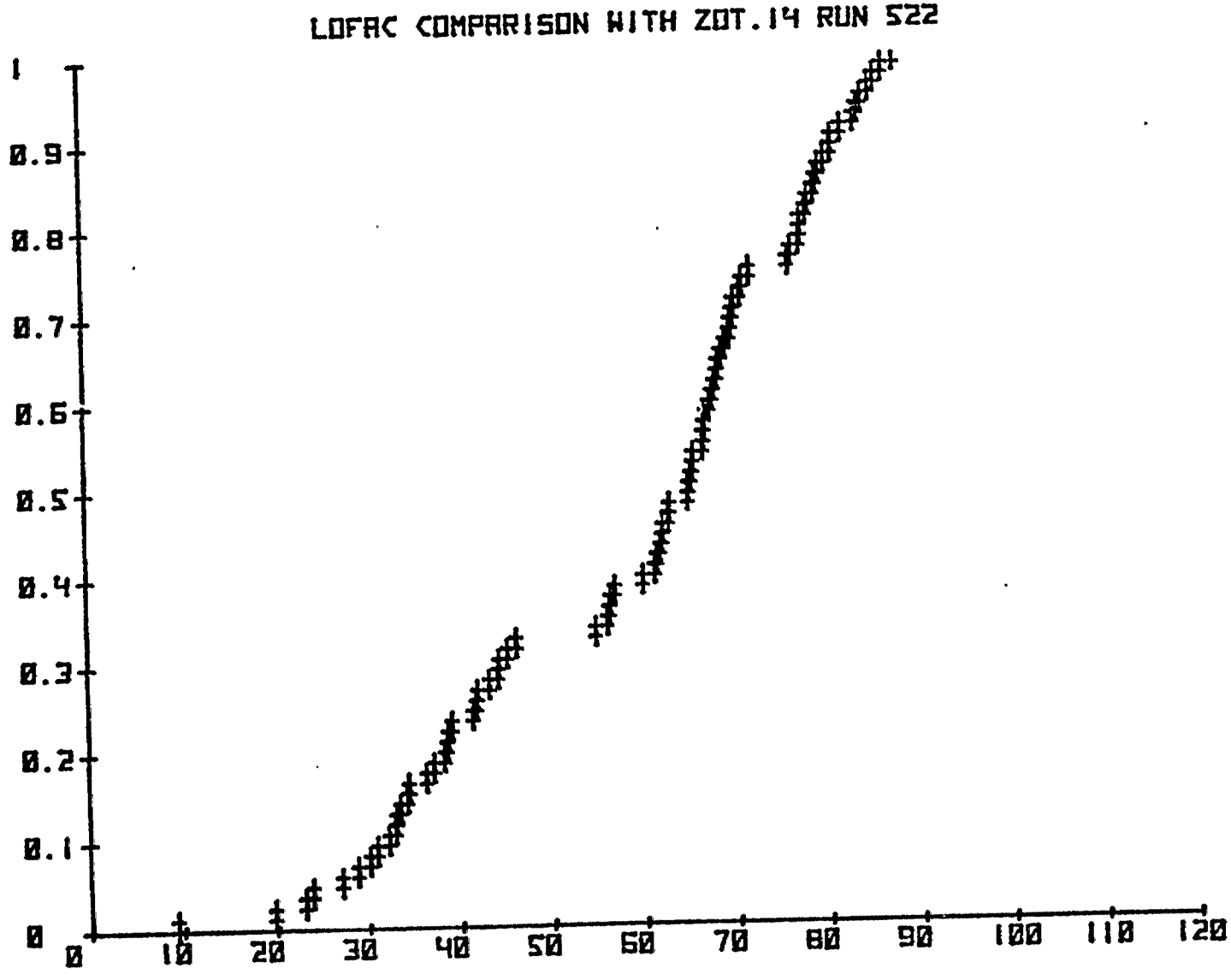
35	9.2946	78	38.6659	16	61.3784	4	67.8804	77	77.8094
5	19.8128	69	38.7978	64	61.6427	2	68.1085	56	78.3795
7	23.1013	70	39.2402	68	62.0363	3	68.4806	8	78.6467
48	23.9025	25	41.4747	13	62.2172	57	68.5453	79	79.2933
19	27.1096	61	41.8518	33	62.3502	21	68.9365	50	79.5702
36	28.8541	84	42.0222	23	62.9386	32	69.4011	41	79.9745
62	30.1243	15	43.3579	40	63.0994	27	69.8650	73	80.5334
58	30.9654	75	44.2779	60	65.1083	1	70.0309	55	81.2490
37	32.2120	24	44.4003	17	65.1897	31	70.2303	20	81.3804
49	32.9207	38	45.3241	82	65.4569	14	70.3895	29	82.4085
63	33.0686	18	46.3181	28	65.6665	54	71.1094	39	83.8447
74	33.5010	53	54.9689	9	65.7552	52	71.3868	81	84.2357
10	34.2726	44	56.1872	46	66.8029	12	72.2080	71	84.6708
66	34.4985	51	5[illegible].4325	80	66.8739	47	76.3879	67	85.5080
11	36.3966	85	56.5594	59	66.9805	45	76.7278	34	86.0835
76	37.2647	72	57.0555	26	67.0303	83	77.6415	42	86.9773
65	38.3519	30	60.1223	43	67.5065	6	77.7954	22	88.2501

OBLIQUITY MEAN 59.1139 DEG, STANDARD DEVIATION 19.3366 DEG

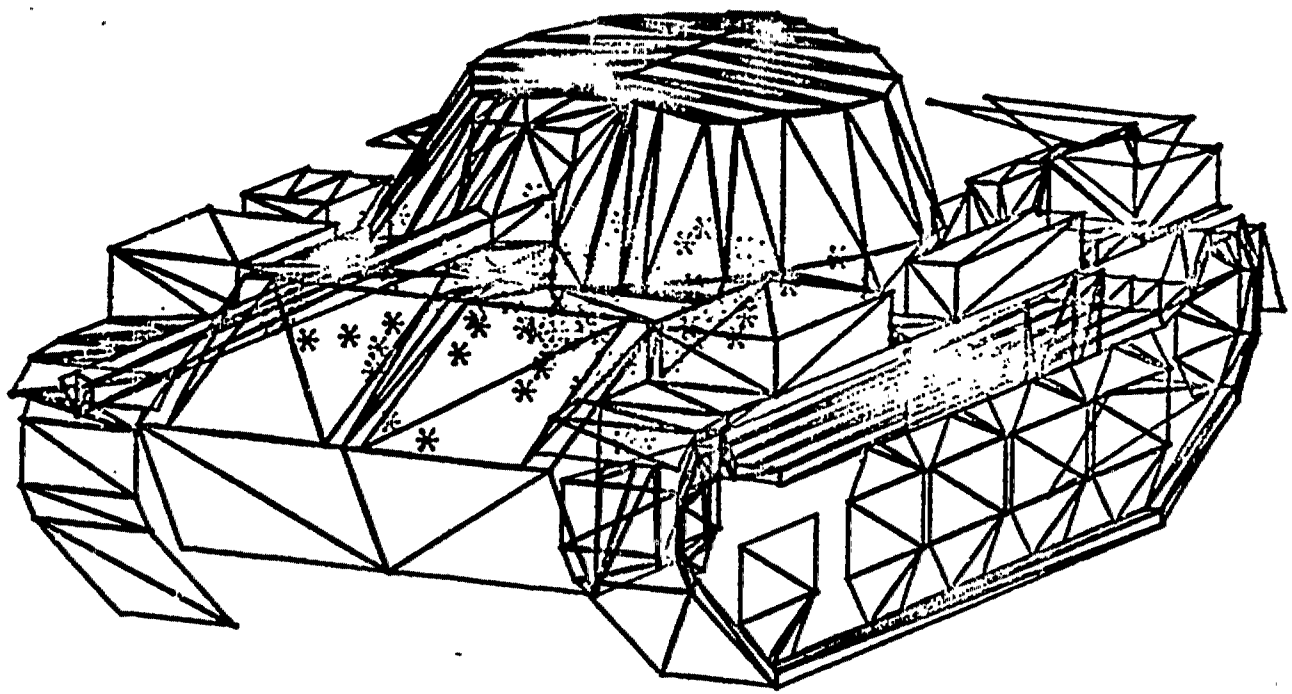
PERCENTILES:

RANK	DEVIATE
0.05	24.86
0.10	31.71
0.15	34.20
0.20	38.41
0.25	41.66
0.30	44.38
0.35	56.21
0.40	60.62
0.45	62.31
0.50	65.19
0.55	66.82
0.60	67.73
0.65	68.90
0.70	70.26
0.75	74.30
0.80	77.81
0.85	79.61
0.90	81.79
0.95	85.26

FACET NO.	NO. OF IMPACTS
136	18
178	7
-136	6
231	6
238	6
135	5
182	5
287	5
242	3
244	3
142	2
240	2
278	2
-242	1
-232	1
-137	1
65	1
202	1
232	1
233	1
235	1
246	1
254	1
270	1
274	1
283	1
284	1
285	1


LOFAC COMPARISON WITH ZOT.14 RUN 522
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 79.0 PHI = 25.7
SCALE: X = -200 TO 100
Y = -80 TO 120



LOFAC COMPARISON WITH ZOT.14 RUN 522

THERE WERE 3 MISSES

THEY WERE REPS #: 40 45 50

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

58	25.9933	71	42.1396	64	56.1923	75	65.0692	65	82.4519
72	27.0022	25	43.5964	13	56.2673	82	66.2596	85	82.9493
39	27.0637	38	46.2050	70	58.0560	9	66.3064	12	83.1264
56	29.9812	33	46.2991	1	59.5274	2	67.1866	3	83.4752
49	30.4503	43	46.7784	68	61.1466	60	67.2031	74	84.2234
62	31.3984	16	47.8048	24	61.2050	31	67.4262	34	84.4105
41	32.8399	81	49.5415	10	61.2645	51	68.2796	20	85.2989
11	34.4343	19	51.4026	46	61.5351	57	68.5821	69	85.3144
66	35.0415	55	51.7454	42	61.6395	47	70.2355	6	87.0005
36	35.7671	35	51.9531	23	61.7104	79	70.3264	54	87.4520
76	36.4170	44	52.5369	67	62.8023	27	71.7115	63	88.8635
78	37.7704	18	53.0495	73	63.0963	37	71.8988	5	89.9257
53	37.8680	29	53.0808	21	63.5895	17	71.9286	30	90.2717
26	40.1786	32	53.5939	80	64.2959	77	73.3956	7	93.2929
15	40.7390	22	54.1836	59	64.5367	48	78.0259		
61	40.9990	52	54.5590	28	64.6502	14	79.4878		
84	42.0498	83	56.1403	4	64.9641	8	81.3235		

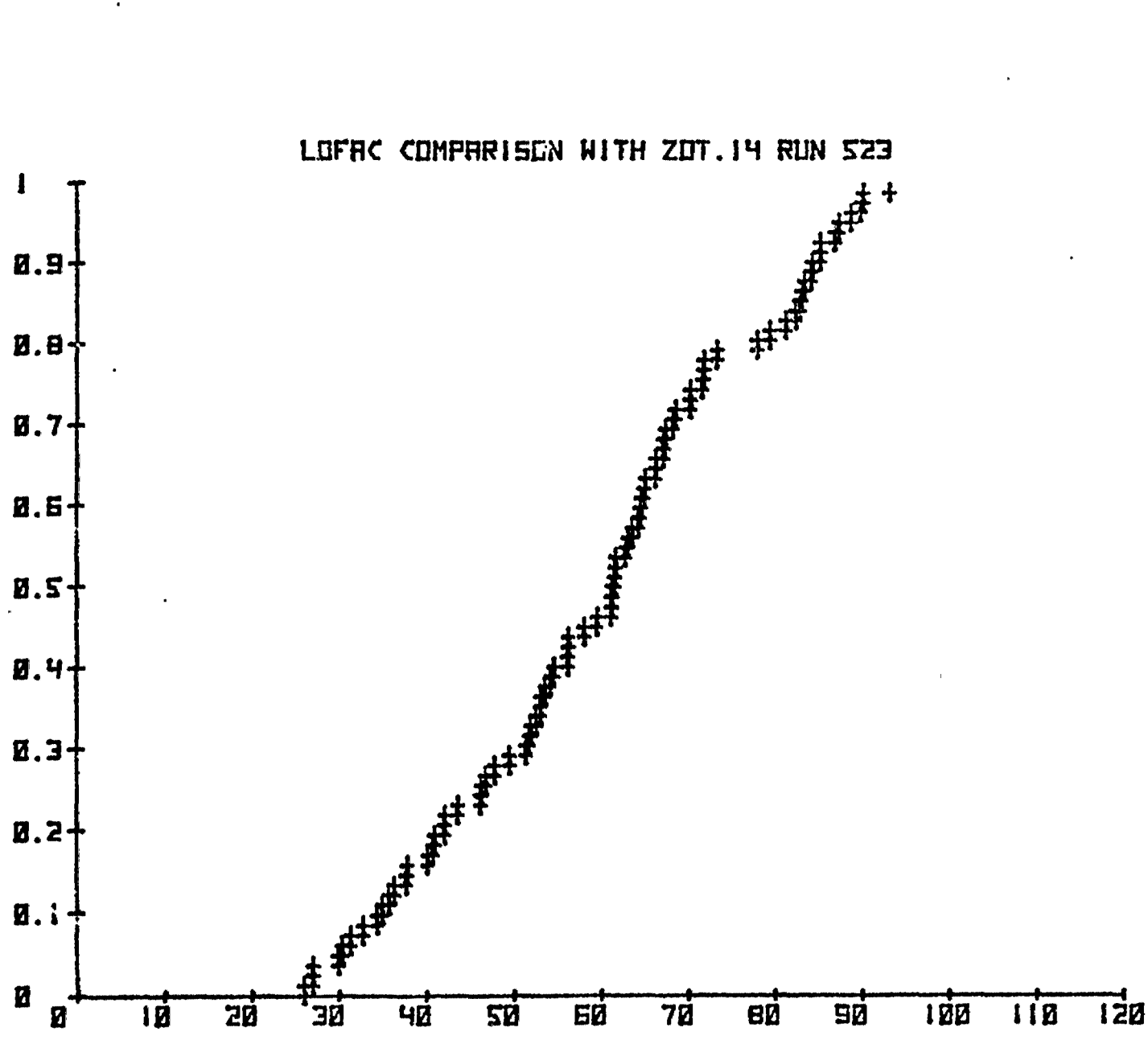
OBLIQUITY MEAN 59.7535 DEG; STANDARD DEVIATION 17.8252 DEG

PERCENTILES:

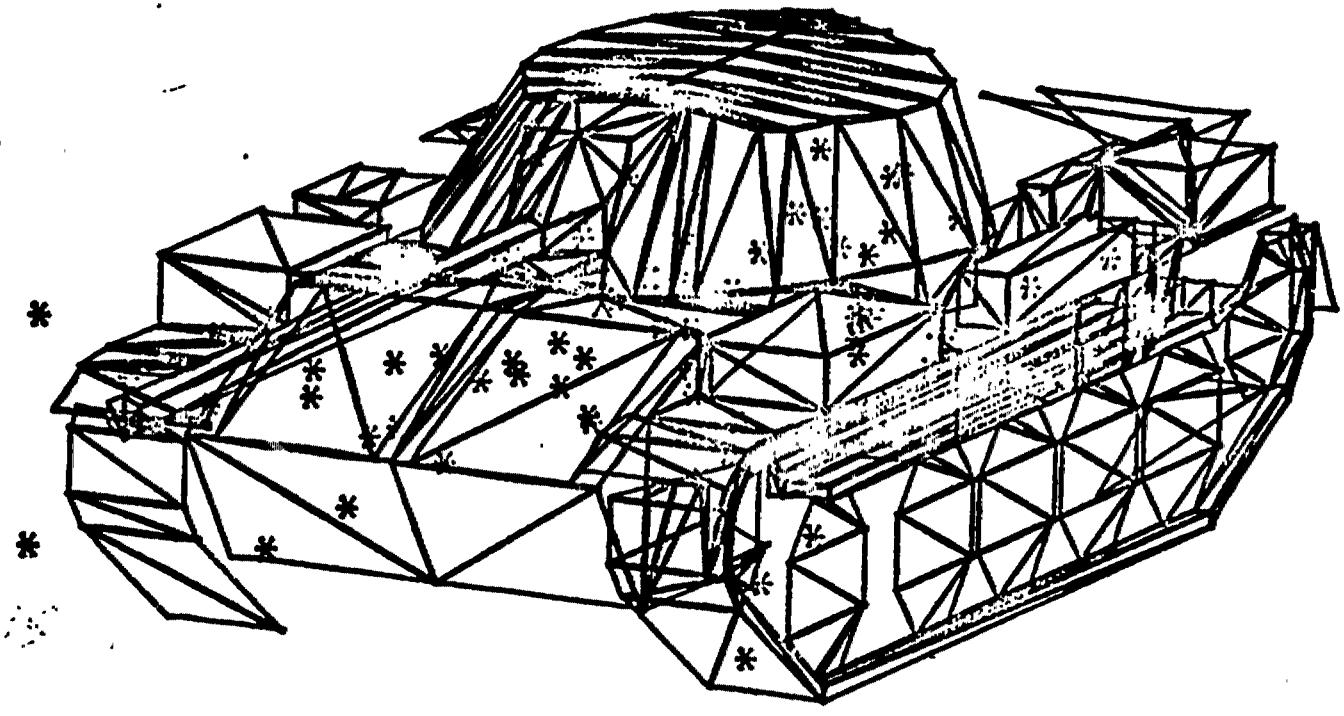
RANK	DEVIATE
0.05	30.05
0.10	34.62
0.15	37.81
0.20	41.63
0.25	46.28
0.30	51.22
0.35	53.05
0.40	54.88
0.45	58.57
0.50	61.40
0.55	62.99
0.60	64.63
0.65	66.30
0.70	68.31
0.75	71.76
0.80	78.61
0.85	83.05
0.90	85.03
0.95	88.65

LOFAC COMPARISON WITH ZOT.14 RUN 523

FACET NO.	NO. OF IMPACTS
136	10
-136	4
178	4
240	4
47	3
179	3
246	3
286	3
287	3
-142	2
-137	2
-134	2
142	2
144	2
184	2
238	2
245	2
247	2
284	2
-278	1
-246	1
-237	1
-146	1
28	1
45	1
46	1
65	1
68	1
132	1
134	1
135	1
146	1
156	1
171	1
196	1
197	1
231	1
233	1
235	1
242	1
244	1
248	1
275	1
282	1


LOFAC COMPARISON WITH ZOT.14 RUN 523
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 78.3 PHI = 25.6
SCALE: X = -200 TO 100
Y = -80 TO 120



LOFAC COMPARISON WITH ZOT.14 RUN 523

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 524 PAGE 1

THERE WERE 12 MISSES

THEY WERE REPS #: 1 4 13 24 26 30 35 40 45 50 64 85

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

71	7.8994	11	41.9899	65	52.3384	21	66.1474	74	83.4004
46	7.9443	38	43.5872	49	52.6436	39	67.5459	34	84.2483
66	20.2937	41	44.2197	52	52.7532	57	68.1948	32	87.2291
47	21.7777	59	44.6797	81	52.8578	23	68.4549	22	89.9503
62	22.1923	16	45.7023	83	54.0245	2	68.7739	25	90.6800
48	22.4999	54	45.9009	84	56.5059	15	69.5984		
36	23.5485	44	46.4424	6	59.5323	7	70.2722		
5	24.8942	67	47.5084	80	60.1742	77	70.7976		
72	26.4267	82	48.2589	69	60.8814	18	71.3772		
19	26.6754	31	48.3883	73	61.4800	20	71.3988		
17	26.9561	63	48.3888	10	61.6336	14	71.4794		
56	29.4017	27	49.0119	43	63.9693	79	72.6578		
78	32.1891	68	49.2097	58	64.1449	33	74.3366		
76	36.5723	61	49.2771	28	64.5478	29	75.4329		
37	39.5711	51	50.4732	8	64.6481	3	77.2351		
9	40.2464	42	50.9046	12	65.0681	75	80.1695		
53	40.4979	55	51.1752	60	65.3701	70	81.3090		

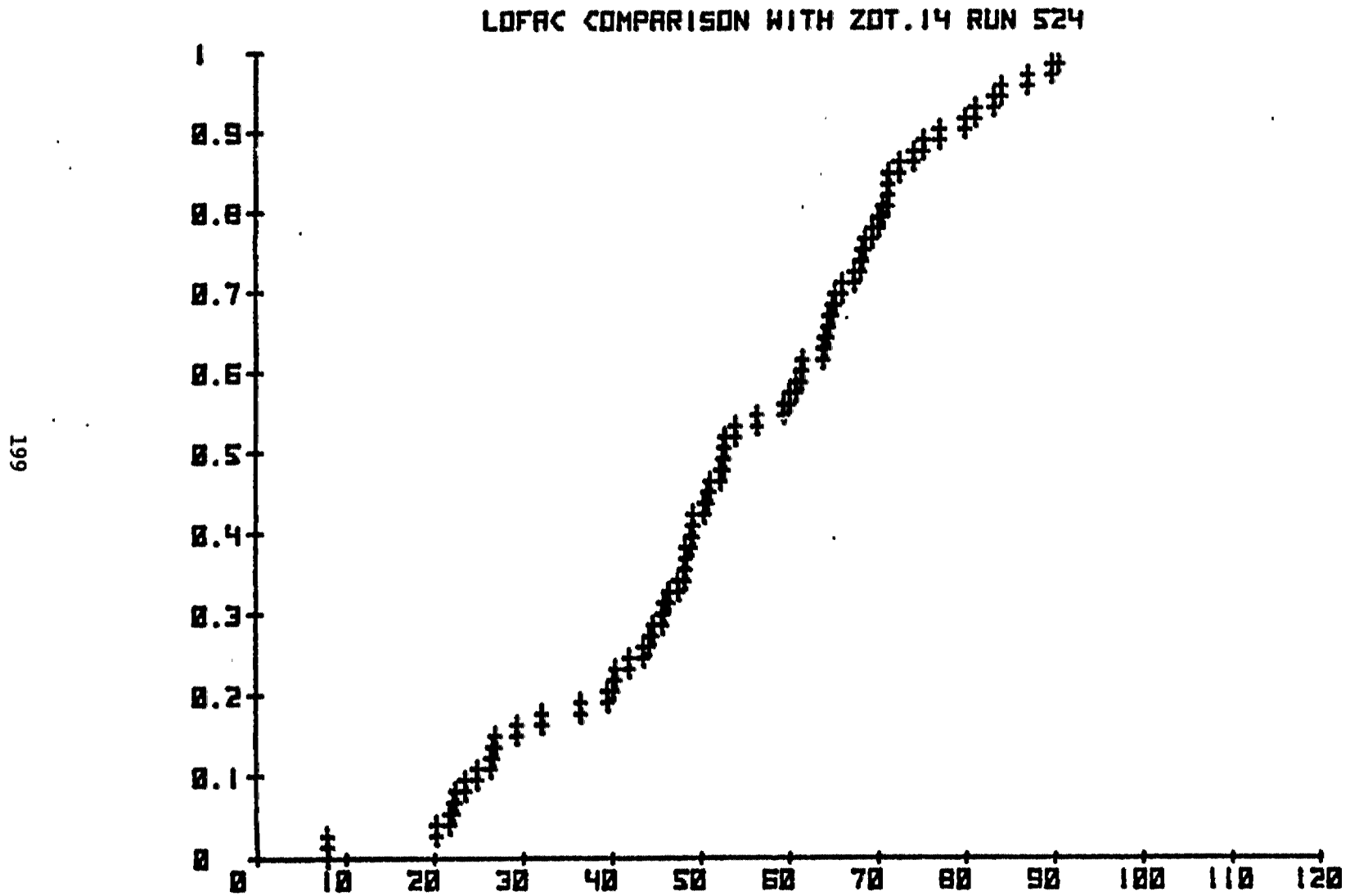
OBLIQUITY MEAN 53.8078 DEG, STANDARD DEVIATION 19.5647 DEG

PERCENTILES:

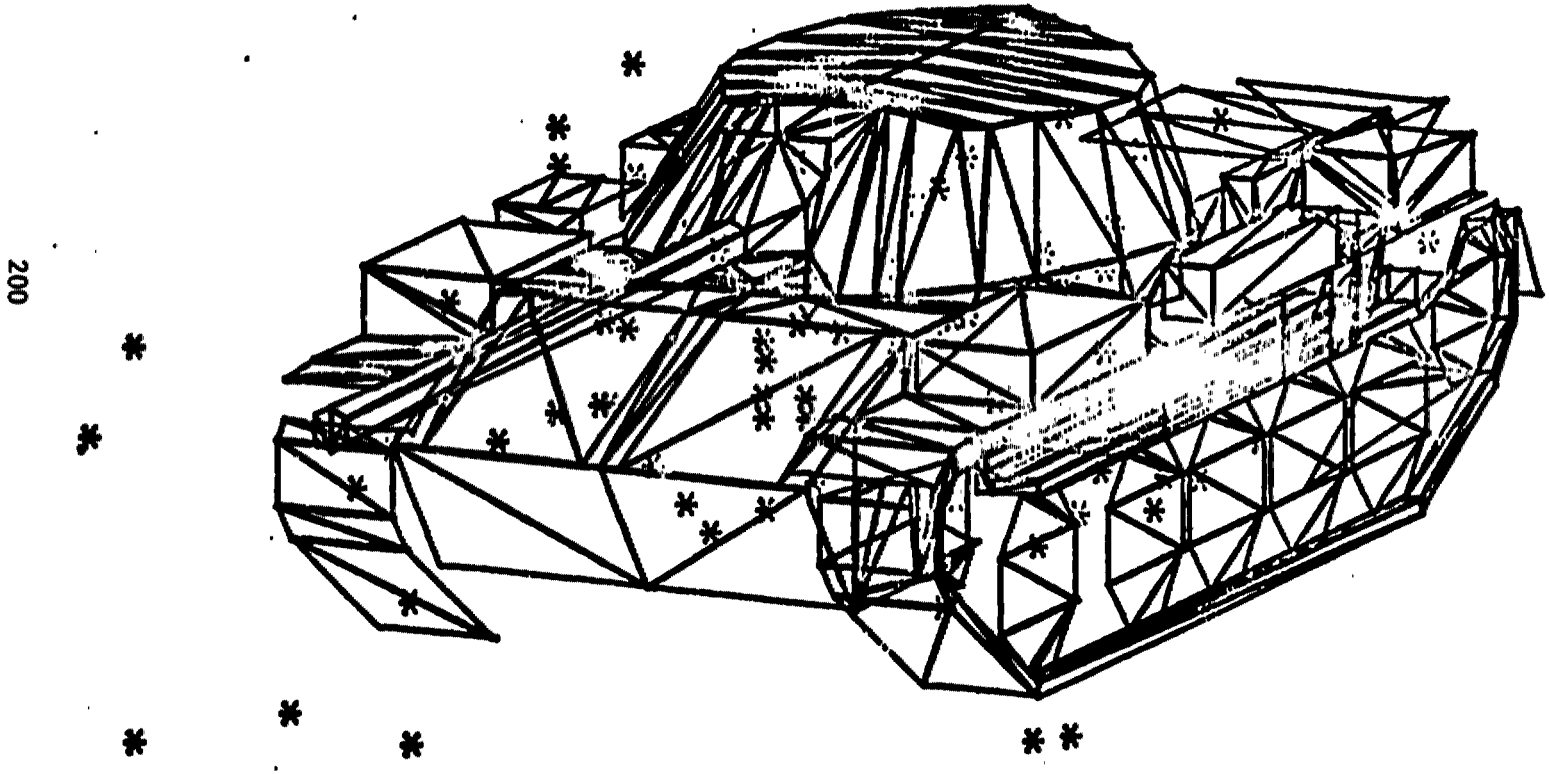
RANK	DEVIATE
0.05	21.33
0.10	24.09
0.15	27.20
0.20	38.97
0.25	42.79
0.30	45.74
0.35	48.18
0.40	49.13
0.45	50.99
0.50	52.75
0.55	58.62
0.60	61.54
0.65	64.56
0.70	65.99
0.75	68.61
0.80	70.91
0.85	72.54
0.90	79.00
0.95	85.14

LOFAC COMPARISON WITH ZOT.14 RUN 524

FACET NO.	NO. OF IMPACTS
136	8
-136	5
178	4
287	4
134	3
47	2
115	2
135	2
247	2
253	2
274	2
286	2
-278	1
-238	1
-212	1
-134	1
-68	1
-66	1
20	1
28	1
43	1
45	1
56	1
67	1
122	1
125	1
129	1
142	1
144	1
168	1
176	1
177	1
179	1
182	1
196	1
197	1
223	1
231	1
240	1
241	1
242	1
243	1
245	1
246	1
249	1
272	1
277	1


LOFAC COMPARISON WITH ZOT.14 RUN 524
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 77.9 PHI = 25.7
SCALE: X = -200 TO 100
Y = -80 TO 120



LOFAC COMPARISON WITH ZOT.14 RUN 524

LOFAC COMPARISON WITH ZOT.14 RUN 525

THERE WERE 14 MISSES

THEY WERE REPS #: 8 13 24 26 30 36 40 42 43 45 52 59 66 82

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

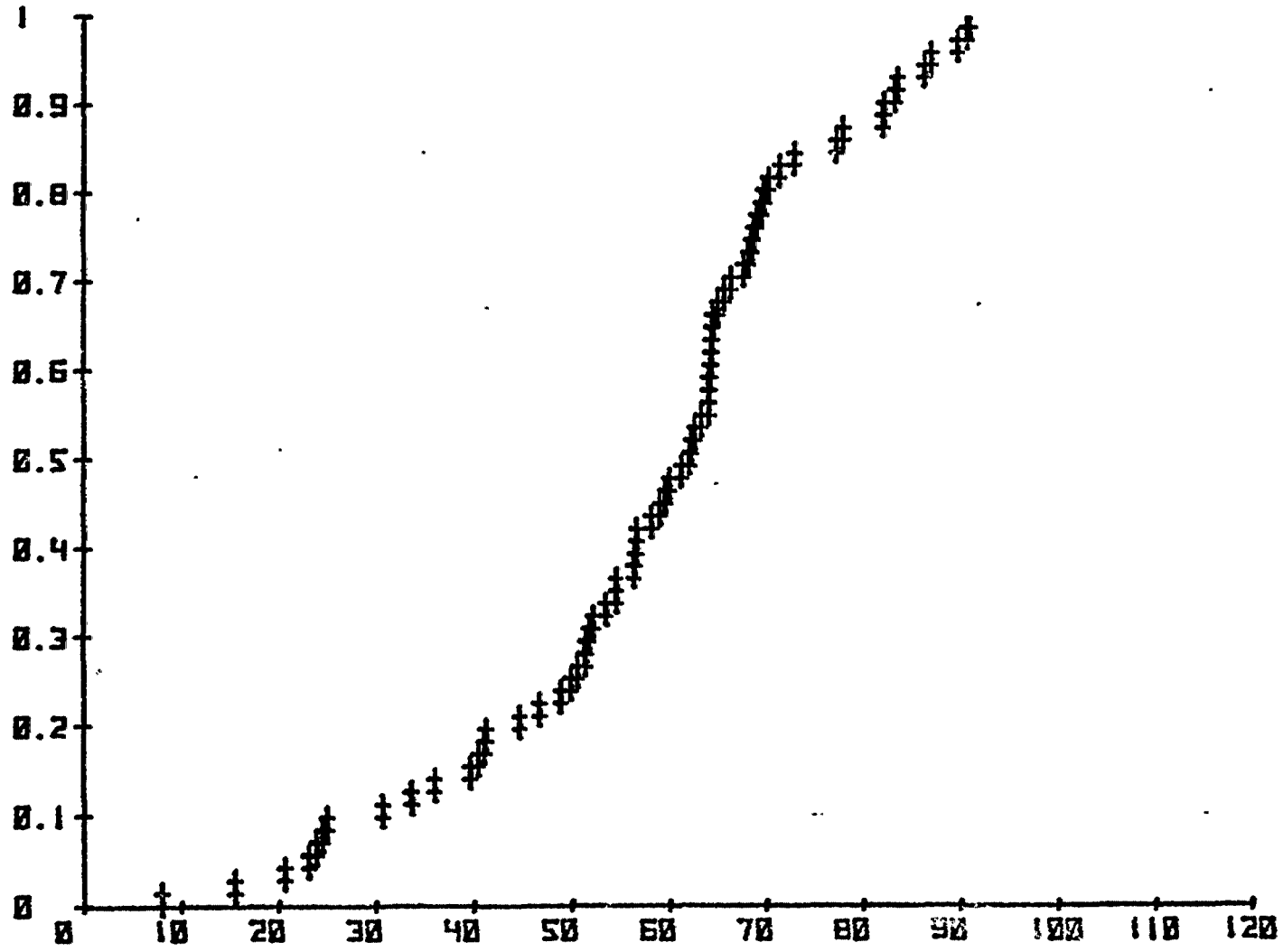
64	8.0111	68	49.8600	39	61.2047	25	68.1886	22	89.7984
1	15.5020	69	50.5235	70	62.0167	3	68.5336	31	90.7165
48	20.6774	74	51.2860	23	62.2042	41	68.7638	5	91.0688
19	23.1261	32	51.4533	53	63.6044	72	69.0787		
47	23.8898	10	51.7456	49	63.2649	50	69.5568		
85	24.4967	29	52.1751	12	64.3248	51	69.8296		
56	24.9295	83	53.4328	80	64.0536	77	70.2792		
28	30.6716	9	54.4999	60	64.0725	62	71.4553		
78	33.6196	73	54.5204	17	64.2479	20	72.9597		
61	36.0187	79	56.2771	58	64.3258	18	77.3365		
46	39.6543	27	56.3924	14	64.3452	76	77.9706		
35	40.4994	7	56.5673	37	64.4123	15	82.0907		
2	41.1011	57	57.5953	55	64.4905	71	82.2725		
65	41.2499	11	58.1271	6	65.0261	34	83.3758		
67	44.6579	38	59.0112	44	65.6733	63	83.6368		
54	46.6861	33	59.5373	21	66.3599	81	86.4035		
84	48.8744	75	60.0105	16	67.6731	4	87.0704		

OBLIQUITY MEAN 58.1143 DEG, STANDARD DEVIATION 18.5515 DEG

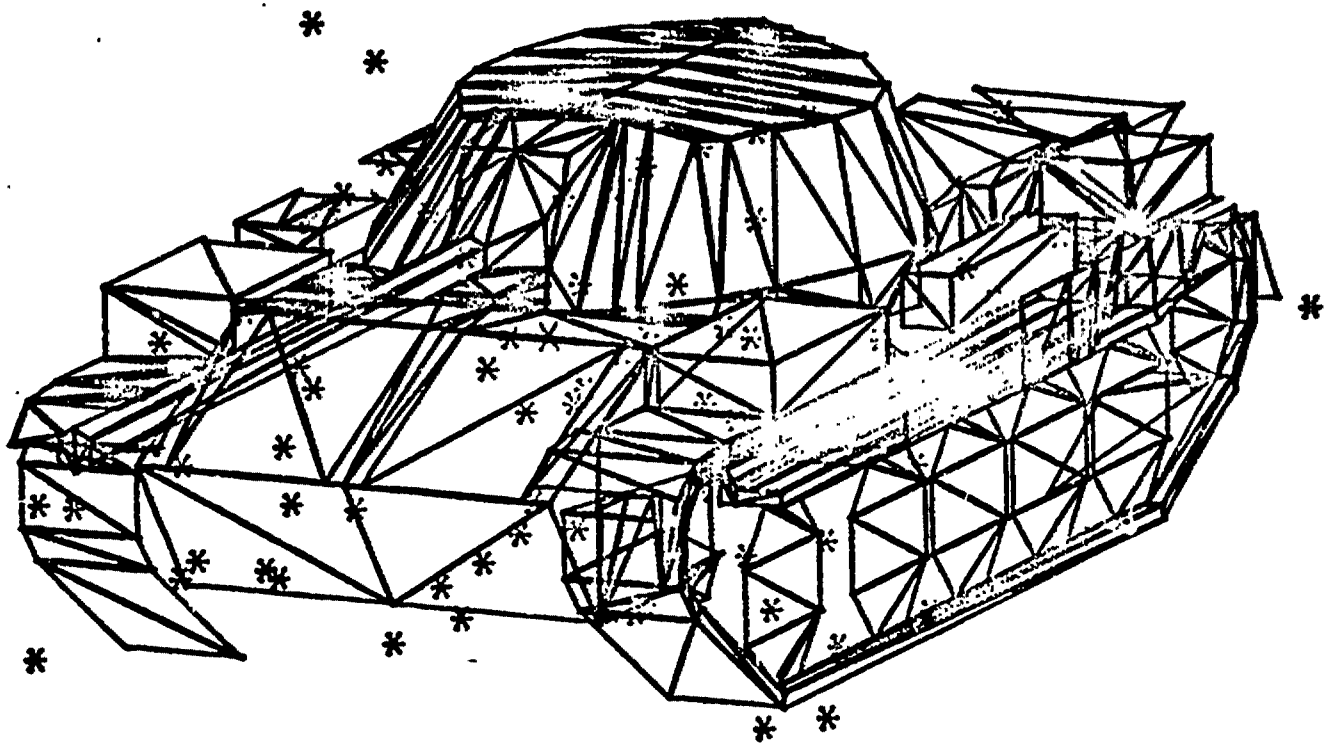
PERCENTILES:

RANK	DEVIATE
0.05	22.15
0.10	26.08
0.15	38.93
0.20	42.61
0.25	49.86
0.30	51.63
0.35	54.50
0.40	56.53
0.45	59.24
0.50	62.02
0.55	63.72
0.60	64.26
0.65	64.47
0.70	66.89
0.75	68.76
0.80	70.10
0.85	77.46
0.90	83.16
0.95	88.16

FACET NO.	NO. OF IMPACTS
-134	5
136	5
134	4
-136	3
67	3
-66	2
46	2
91	2
129	2
178	2
182	2
184	2
199	2
231	2
-241	1
-235	1
-231	1
-199	1
-146	1
47	1
61	1
82	1
95	1
106	1
125	1
132	1
135	1
146	1
177	1
179	1
183	1
188	1
197	1
209	1
223	1
233	1
239	1
240	1
242	1
243	1
245	1
270	1
275	1
286	1
287	1
295	1
297	1


LOFAC COMPARISON WITH ZOT.14 RUN 525
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 77.5 PHI = 25.7
SCALE: X = -200 TO 100
Y = -80 TO 120



LOFRC COMPARISON WITH ZOT.14 RUN 525

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 526 PAGE 1

THERE WERE 0 MISSES

THEY WERE REPS #:

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

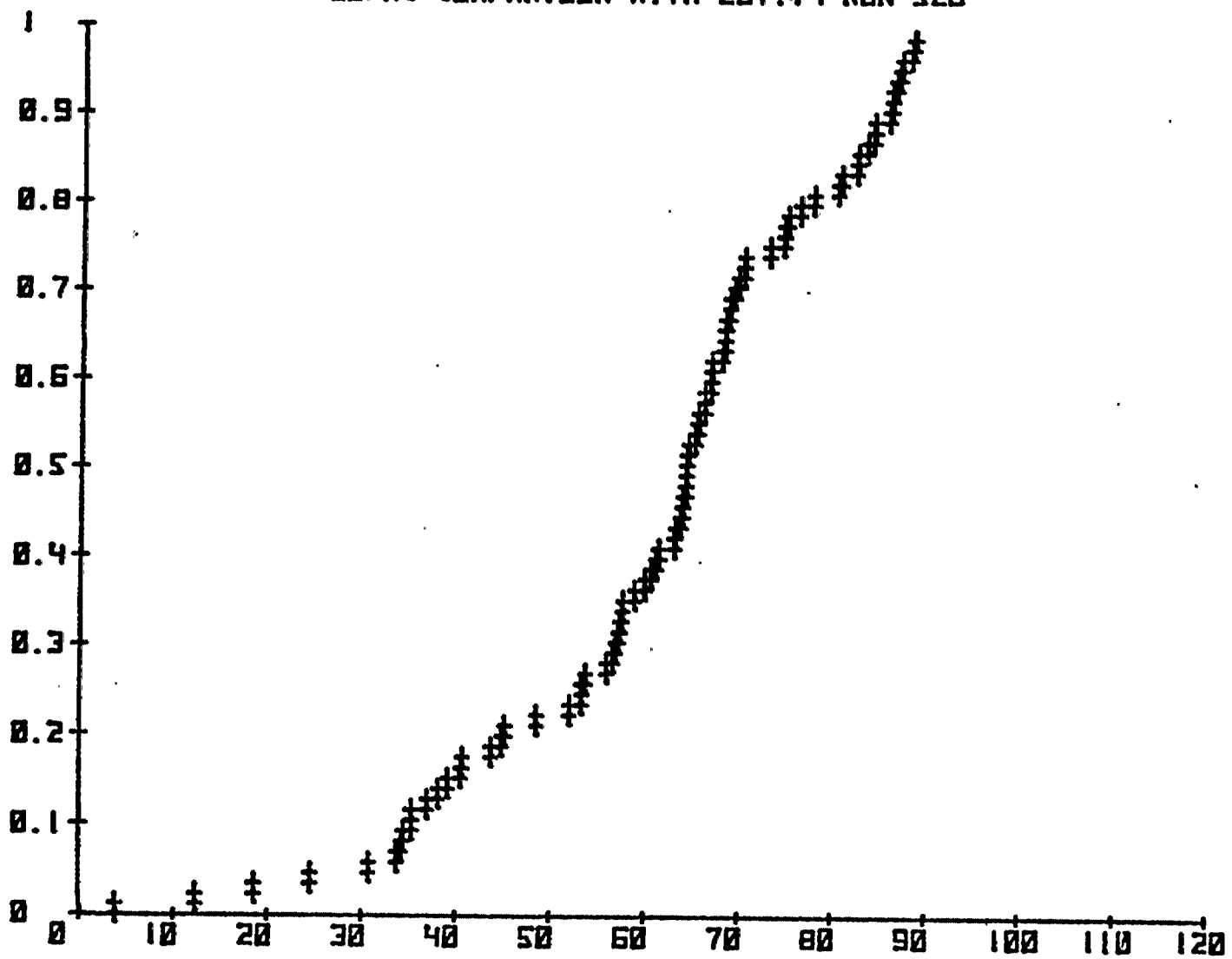
78	3.9128	59	45.2682	16	61.4913	46	66.9909	39	77.8107
35	12.4296	18	48.6644	55	63.1513	23	67.0498	11	80.4105
42	18.6671	73	52.1434	33	63.2592	1	68.1190	49	80.7738
7	24.6229	75	53.3730	10	63.7780	9	68.3886	8	82.3618
65	30.8653	48	53.4047	24	63.9795	26	68.3971	57	82.5565
12	33.8325	53	53.8002	21	64.0581	4	68.5142	41	83.5297
61	34.3455	62	56.0591	64	64.3374	27	68.9077	81	84.2097
38	34.5801	83	56.6977	13	64.3746	72	68.9343	34	84.3008
74	35.4024	79	56.9901	3	64.4169	40	69.4425	82	85.8952
76	35.4191	19	57.2891	29	64.4471	52	69.8489	20	86.1073
84	37.0982	80	57.4441	6	64.6293	14	70.3989	60	86.1544
70	38.2535	47	57.6821	50	65.3099	85	70.4873	43	86.5816
25	39.2897	51	57.7578	32	65.5616	36	73.1388	54	86.9545
71	40.6705	44	58.9798	68	65.6811	66	74.6660	63	87.1642
67	40.7956	56	60.0927	2	66.3152	30	74.7359	31	88.1706
69	43.8197	77	60.6982	37	66.3181	45	75.0688	5	88.4107
15	44.9162	17	61.2027	28	66.9379	58	76.3572	22	88.5509

OBLIQUITY MEAN 61.5753 DEG, STANDARD DEVIATION 18.3921 DEG

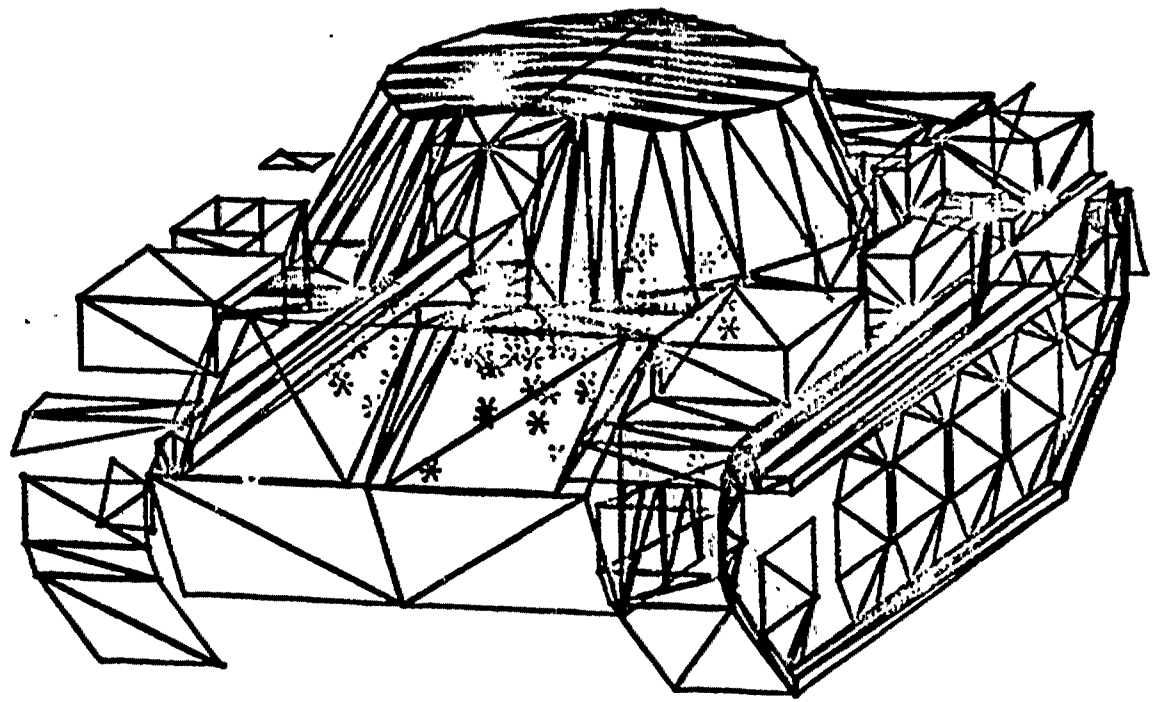
PERCENTILES:

RANK	DEVIATE
0.05	26.50
0.10	35.07
0.15	39.19
0.20	44.99
0.25	53.39
0.30	56.93
0.35	57.88
0.40	61.32
0.45	63.92
0.50	64.42
0.55	65.60
0.60	66.97
0.65	68.40
0.70	69.52
0.75	73.90
0.80	77.52
0.85	82.65
0.90	85.98
0.95	87.10

FACET NO.	NO. OF IMPACTS
136	25
231	10
-136	5
242	5
232	4
135	3
178	3
285	3
142	2
182	2
234	2
239	2
244	2
274	2
-253	1
-241	1
-231	1
-137	1
137	1
235	1
238	1
241	1
247	1
270	1
277	1
278	1
284	1
286	1
287	1


LOFAC COMPARISON WITH ZOT.14 RUN 526
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 78.1 PHI = 18.0
SCALE: X = -200 TO 100
Y = -80 TO 120



LOFAC COMPARISON WITH ZOT.14 RUN 526

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 527 PAGE 1

THERE WERE 3 MISSES

THEY WERE REPS #: 1 45 73

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

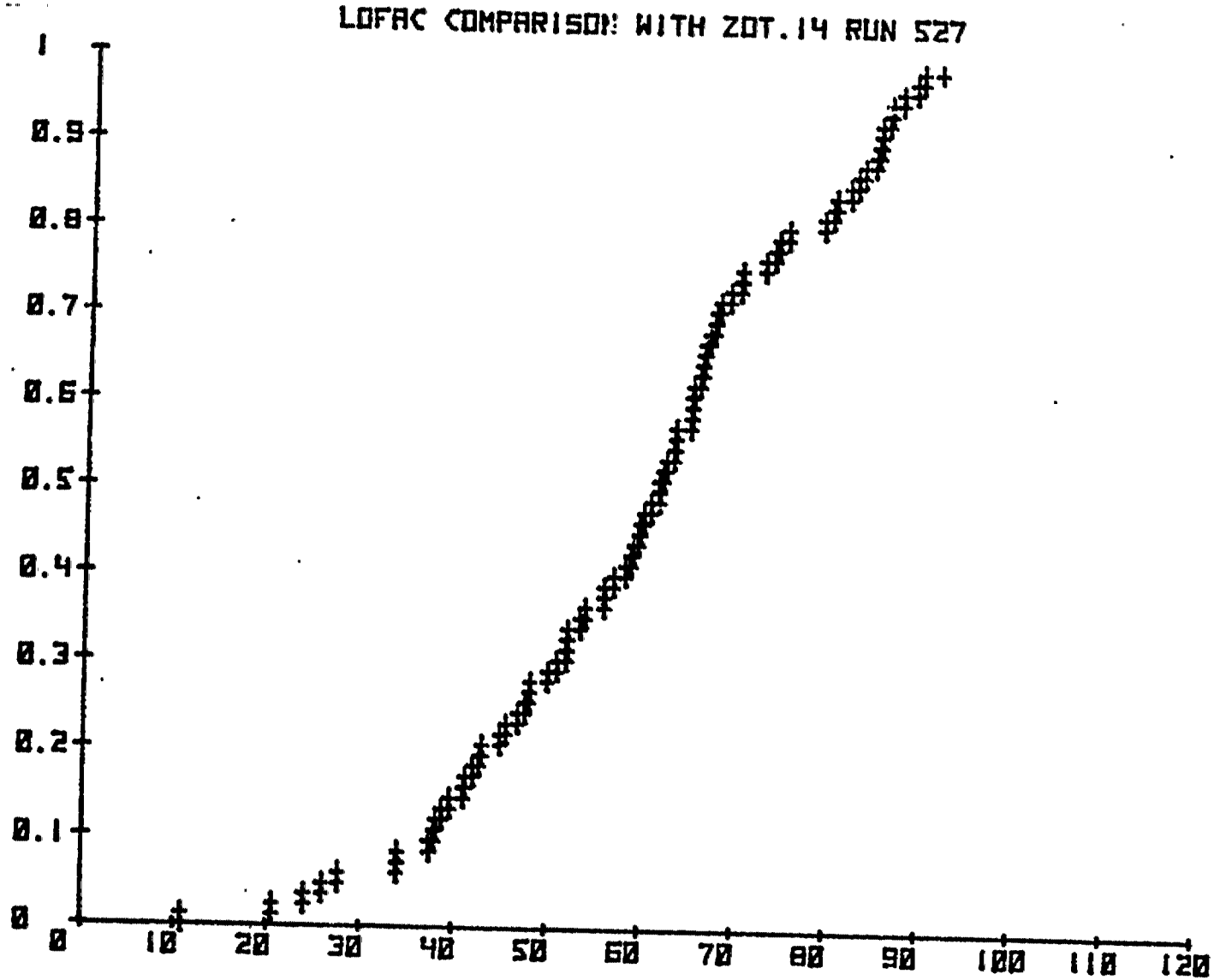
57	10.7961	38	44.9565	13	58.7262	32	65.8867	69	80.1990
59	20.6587	33	45.5579	29	58.9976	62	66.0902	41	81.7238
28	24.0476	40	46.8172	70	59.5348	31	66.2554	65	82.5045
18	25.9603	52	47.5751	3	59.7208	54	66.3863	21	83.1980
58	27.6715	36	48.0428	72	60.1177	2	66.7774	63	84.3633
61	34.0145	4	48.1215	43	60.8461	20	67.2788	39	84.7036
35	34.1091	47	49.9664	34	61.6473	37	67.4966	81	84.9044
84	37.4804	83	50.9728	82	61.7096	12	67.8958	79	84.9447
66	37.9785	44	51.9210	19	62.1016	23	68.9375	50	85.7927
49	38.1859	16	52.0598	30	62.4027	9	70.0037	60	85.9899
25	38.7870	15	52.0743	85	63.1866	27	70.1732	6	87.1834
26	39.6025	56	53.4009	42	63.3641	77	72.6427	22	88.6864
71	41.1169	17	53.9096	55	63.4028	80	73.6365	5	89.3905
76	41.2867	10	55.9098	51	64.9505	67	74.0823	7	91.3154
78	42.0890	68	55.9451	14	65.0415	11	75.0632		
74	42.7427	75	56.9717	46	65.0754	8	78.9249		
53	43.0372	64	58.1737	24	65.1742	48	79.8535		

OBLIQUITY MEAN 59.7588 DEG, STANDARD DEVIATION 17.8293 DEG

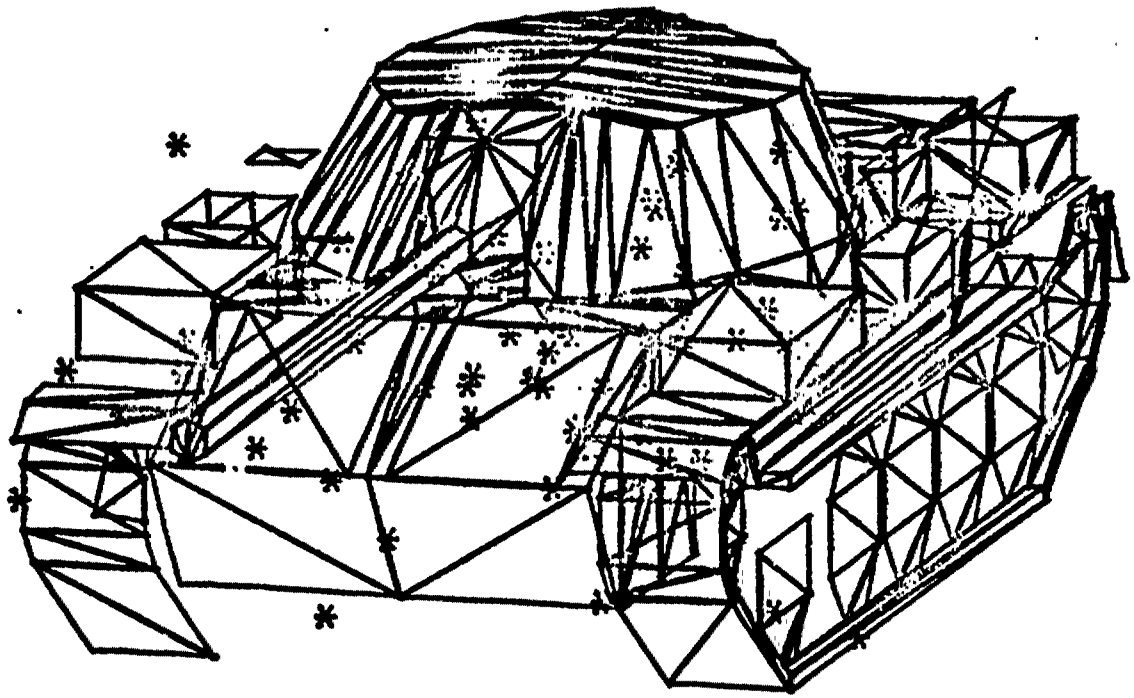
PERCENTILES:

RANK	DEVIATE
0.05	26.22
0.10	37.63
0.15	40.28
0.20	42.92
0.25	47.39
0.30	50.87
0.35	53.43
0.40	57.21
0.45	59.60
0.50	61.68
0.55	63.30
0.60	65.07
0.65	66.25
0.70	67.54
0.75	70.79
0.80	76.61
0.85	82.15
0.90	84.84
0.95	87.00

FACET NO.	NO. OF IMPACTS
136	12
178	4
179	4
231	4
242	4
46	3
142	3
286	3
-232	2
-146	2
-136	2
65	2
134	2
182	2
222	2
244	2
287	2
-290	1
-280	1
-242	1
-240	1
-238	1
-231	1
-142	1
-137	1
-135	1
-134	1
36	1
44	1
129	1
135	1
137	1
144	1
171	1
197	1
214	1
243	1
246	1
247	1
248	1
270	1
281	1
284	1
285	1


LOFAC COMPARISON WITH ZOT.14 RUN 527
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 78.4 PHI = 16.8
SCALE: X = -200 TO 100
Y = -80 TO 120



LOFRC COMPARISON WITH ZOT.14 RUN 527

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 528 PAGE 1

THERE WERE 11 MISSES

THEY WERE REPS #: 1 13 16 24 26 40 45 50 53 57 64

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

70	8.7445	56	47.8362	52	57.8976	62	69.8056	6	85.8724
72	21.7737	83	48.0110	33	58.2185	76	71.0824	39	85.8811
73	22.2736	68	48.0712	82	58.2592	23	71.2813	9	87.3095
30	27.4649	77	48.2315	37	59.9845	10	72.5353	18	89.0431
28	28.1071	43	48.8893	69	61.3894	78	72.5432	41	89.2098
74	33.1052	49	49.9799	44	61.8385	54	72.6331	2	89.2578
61	38.7445	80	51.0003	5	61.8819	48	73.4302		
51	39.9331	67	51.9493	32	62.0350	79	73.7847		
66	40.8757	15	53.1207	35	62.6359	63	81.3843		
84	43.1296	47	54.0378	12	62.6748	59	81.6716		
71	43.7849	21	54.1268	20	63.0129	8	83.1409		
85	44.1205	17	55.0934	65	63.1142	75	83.1425		
4	44.9275	7	55.2925	3	64.2595	60	83.8394		
25	45.0452	11	55.3641	58	64.3950	61	83.9428		
22	45.1594	14	56.1097	19	65.8332	34	85.2845		
38	46.5762	26	57.3329	55	68.9287	29	85.5391		
46	46.6716	31	57.3714	27	69.1575	42	85.8217		

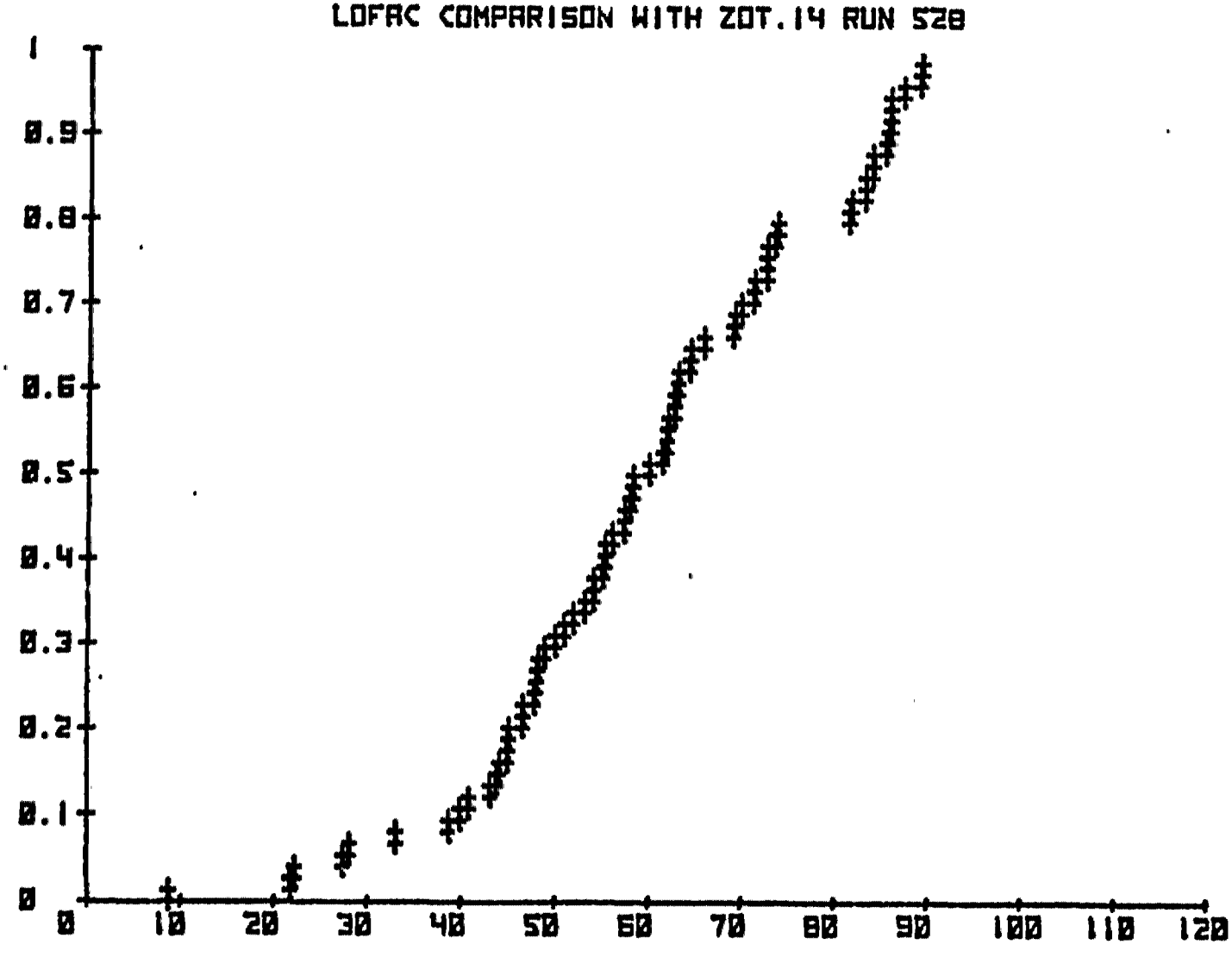
OBLIQUITY MEAN 59.9352 DEG, STANDARD DEVIATION 18.0310 DEG

PERCENTILES:

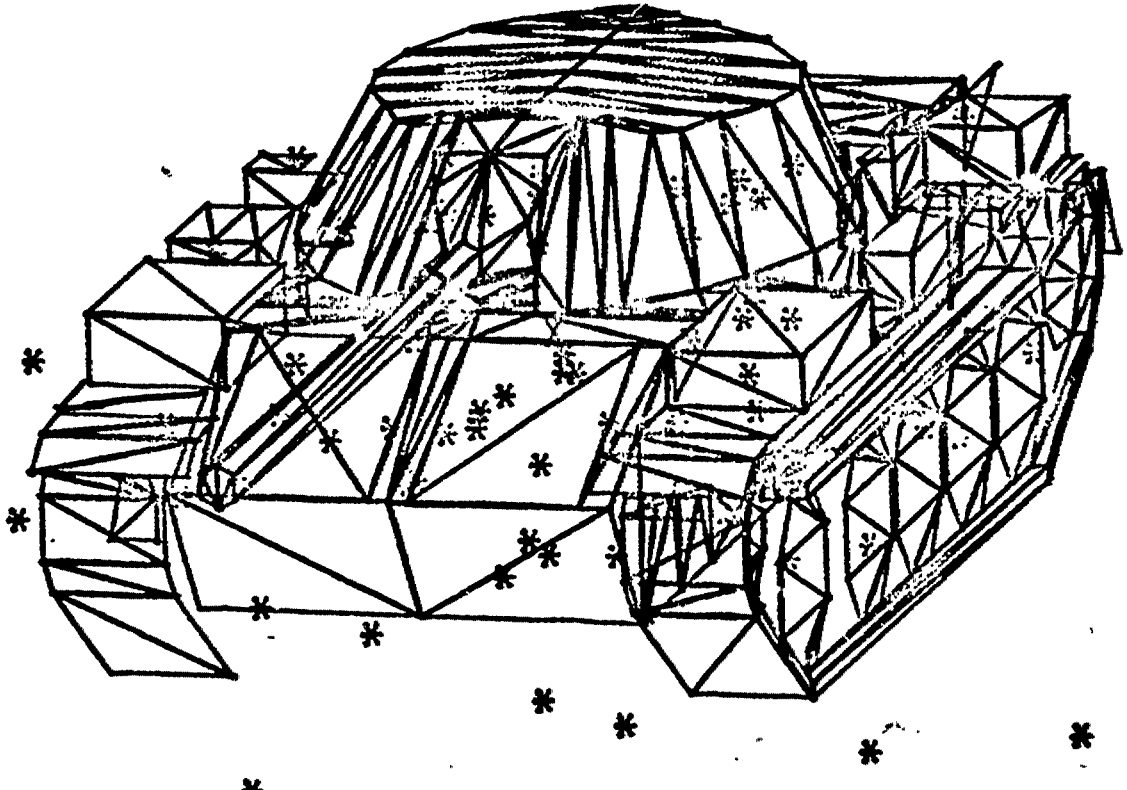
RANK	DEVIATE
0.05	26.17
0.10	39.34
0.15	43.87
0.20	45.16
0.25	47.97
0.30	49.43
0.35	53.35
0.40	55.29
0.45	57.36
0.50	59.12
0.55	61.92
0.60	63.01
0.65	65.47
0.70	70.44
0.75	72.57
0.80	81.38
0.85	83.67
0.90	85.68
0.95	87.74

LOFAC COMPARISON WITH ZOT.14 RUN 528

FACET NO.	NO. OF IMPACTS
136	9
178	5
-136	4
134	4
287	3
-238	2
-134	2
44	2
118	2
146	2
246	2
254	2
-283	1
-271	1
-243	1
-234	1
-232	1
-144	1
46	1
65	1
67	1
101	1
108	1
122	1
129	1
135	1
137	1
141	1
142	1
171	1
182	1
187	1
188	1
203	1
209	1
223	1
243	1
244	1
245	1
248	1
249	1
253	1
271	1
272	1
275	1
283	1
286	1


LOFRC COMPARISON WITH ZOT.14 RUN 528
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 77.0 PHI = 15.9
SCALE: X = -200 TO 100
Y = -80 TO 120



LOFRC COMPRISON WITH ZOT.14 RUN 528

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 529 PAGE 1

THERE WERE 21 MISSES

THEY WERE REPS #: 1 5 8 13 16 24 26 30 33 40 43 44 45
50 52 53 55 57 64 68 76

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

11	23.9306	47	51.2874	61	60.9543	41	78.6283
70	29.0508	79	52.0314	83	61.0484	54	79.4371
35	29.5405	31	54.6325	60	61.0746	49	81.0928
51	29.9176	59	54.6525	73	61.7067	84	81.4288
66	30.3741	14	55.0168	6	63.0725	81	83.5633
19	31.3398	82	55.0389	36	63.7391	22	84.0268
58	32.8745	15	55.3917	29	65.3664	10	84.2738
39	37.3850	80	55.4432	56	66.1184	74	84.9021
72	38.1105	28	55.8140	65	67.6743	3	86.7717
27	40.6118	34	56.0017	85	69.1356	16	87.0857
71	41.1917	63	56.8384	23	69.7394	78	87.7085
9	41.8176	4	58.2099	7	70.4866	25	88.2228
77	43.6046	21	59.1512	37	72.6270	69	88.7265
38	46.6146	12	59.9301	48	72.6591		
46	49.2620	20	59.9339	75	74.1507		
62	49.8722	32	59.9919	67	77.2540		
17	50.6682	2	60.3104	42	77.3186		

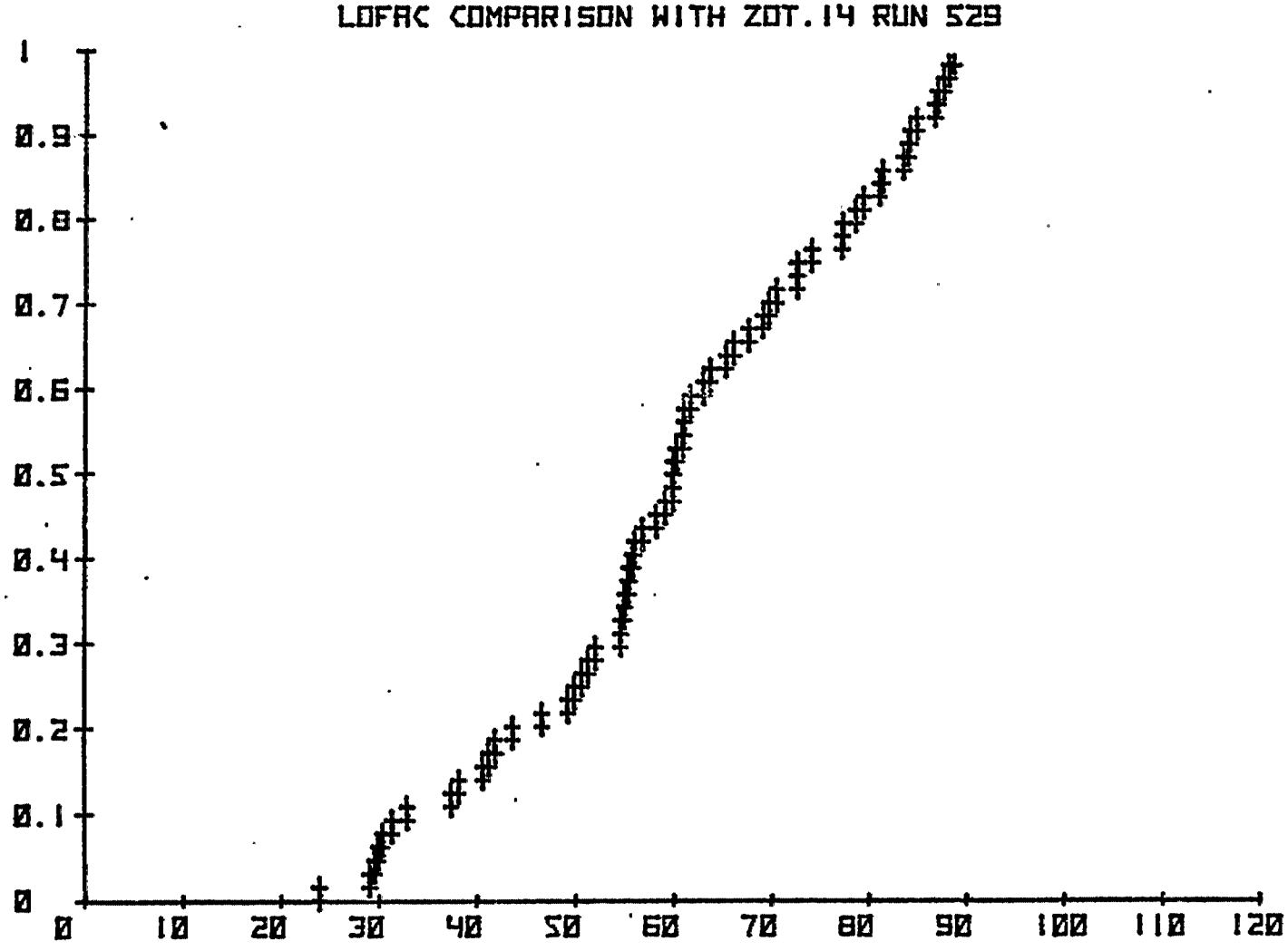
OBLIQUITY MEAN 60.2474 DEG; STANDARD DEVIATION 17.3815 DEG

PERCENTILES:

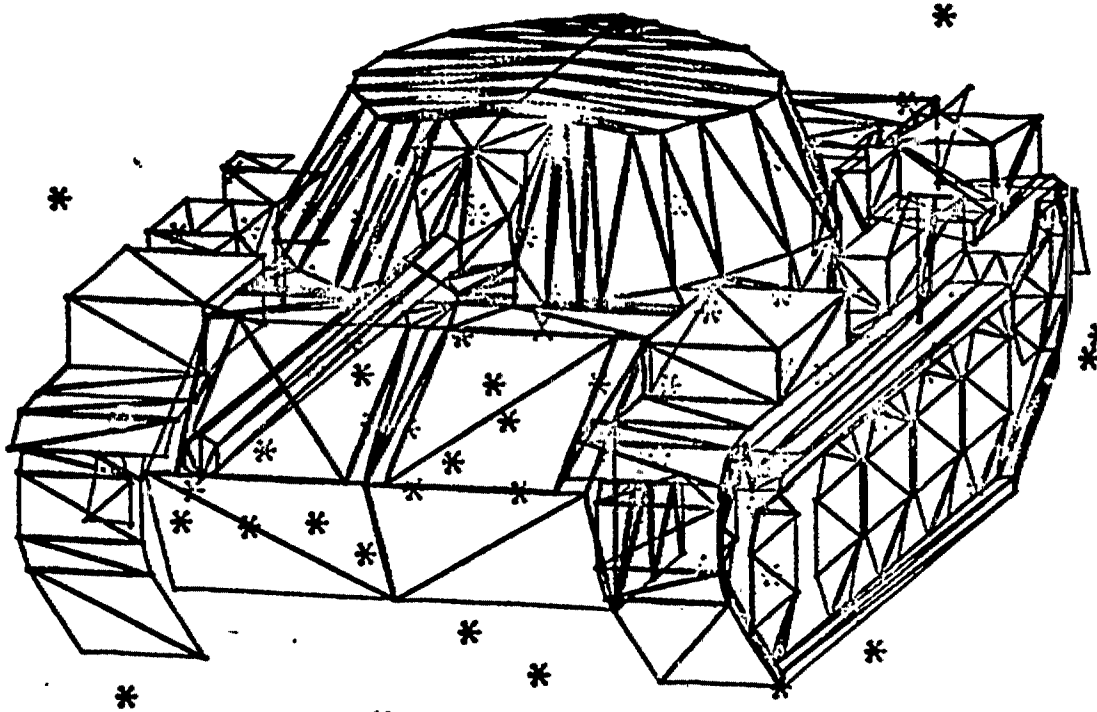
RANK	DEVIATE
0.05	29.63
0.10	32.11
0.15	39.99
0.20	43.60
0.25	50.07
0.30	53.33
0.35	55.03
0.40	55.81
0.45	58.45
0.50	59.96
0.55	61.02
0.60	63.07
0.65	66.51
0.70	70.11
0.75	73.78
0.80	78.63
0.85	81.96
0.90	84.59
0.95	87.55

LOFAC COMPARISON WITH ZOT.14 RUN 529

FACET NO:	NO: OF IMPACTS
136	6
-134	5
286	3
-136	3
66	2
142	2
178	2
182	2
235	2
-280	1
-272	1
-246	1
-245	1
-242	1
-238	1
-235	1
-142	1
28	1
40	1
44	1
45	1
46	1
68	1
82	1
83	1
92	1
99	1
118	1
129	1
132	1
134	1
137	1
144	1
179	1
199	1
203	1
212	1
223	1
229	1
244	1
248	1
254	1
270	1
275	1
283	1


LOFRC COMPARISON WITH ZOT.14 RUN 529
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 77.8 PHI = 15.0
SCALE: X = -200 TO 100
Y = -80 TO 120



LOFAC COMPARISON WITH ZOT.14 RUN 529

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 530 PAGE 1

THERE WERE 0 . MISSES

THEY WERE REPS #:

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

35	21.0511	37	41.6131	19	65.2535	50	69.8479	29	83.2341
69	22.2995	18	41.7300	45	65.3864	57	69.9803	67	85.8148
75	22.8651	63	41.8190	68	65.8698	31	71.7628	5	86.5485
62	26.4461	38	43.1679	16	66.2708	1	71.7746	34	86.8308
11	29.9214	10	43.2978	23	66.2796	4	72.2114	42	86.9838
66	29.9956	71	43.4785	60	66.5865	27	72.2137	6	87.4044
58	30.1085	65	49.2474	40	67.7498	32	72.2323	22	88.5528
70	32.4447	24	49.3573	28	67.8027	54	72.6599	12	88.8457
74	32.7032	30	49.8132	46	67.8512	52	74.3346	3	89.0410
7	32.9832	36	50.4073	13	68.0677	72	75.1726	21	89.1544
76	33.7254	14	52.4928	59	68.0758	47	76.5000		
48	33.8722	33	54.4231	9	68.3182	77	78.9192		
49	35.4421	44	57.4367	43	68.6110	56	78.9775		
15	36.4649	53	58.1585	17	68.9341	8	79.9729		
78	37.4385	51	59.6695	26	69.2604	41	80.7417		
61	37.8173	64	63.0382	55	69.6487	20	82.2597		
25	39.6893	73	64.1602	2	69.6731	39	82.7978		

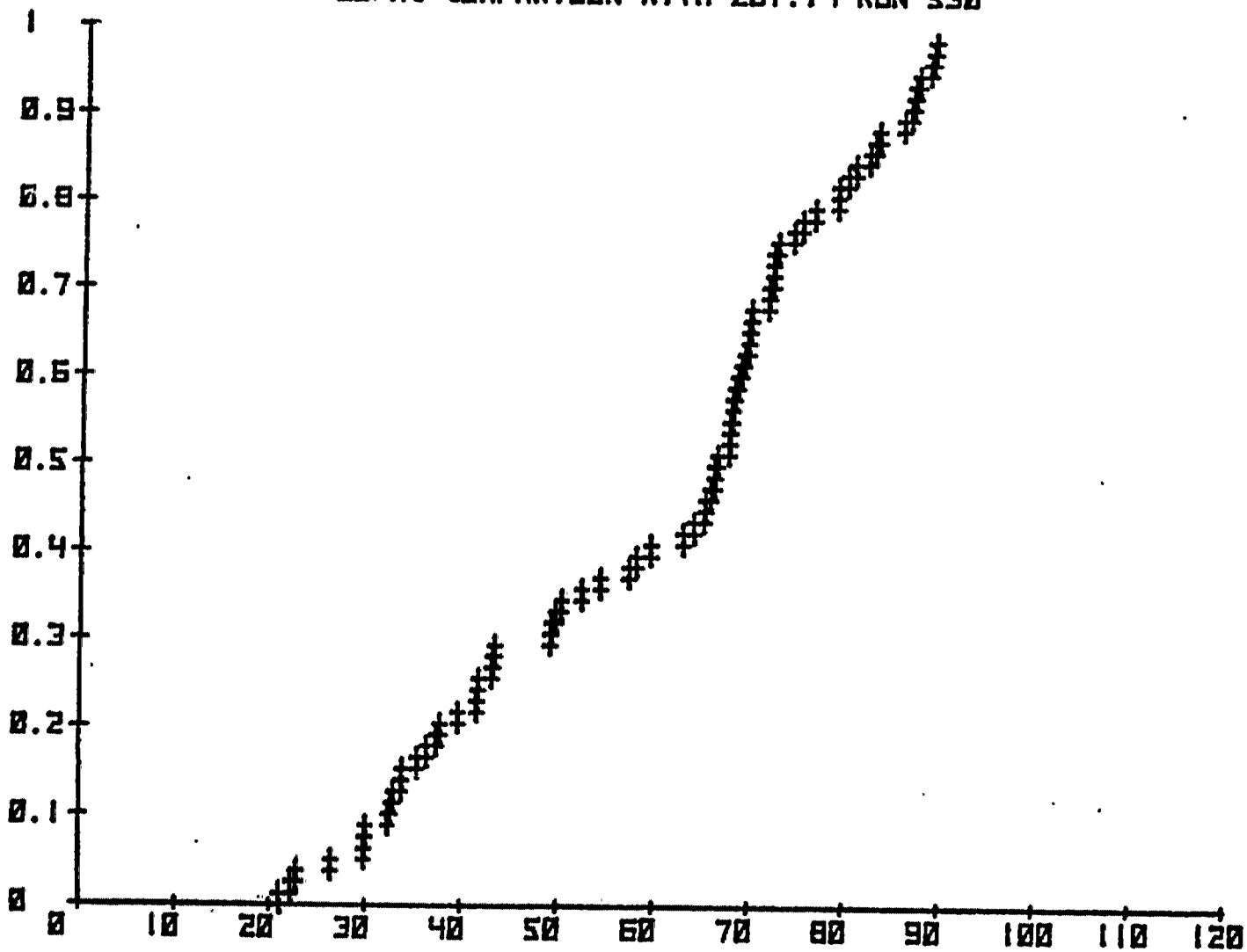
OBLIQUITY MEAN 60.2945 DEG, STANDARD DEVIATION 19.5813 DEG

PERCENTILES:

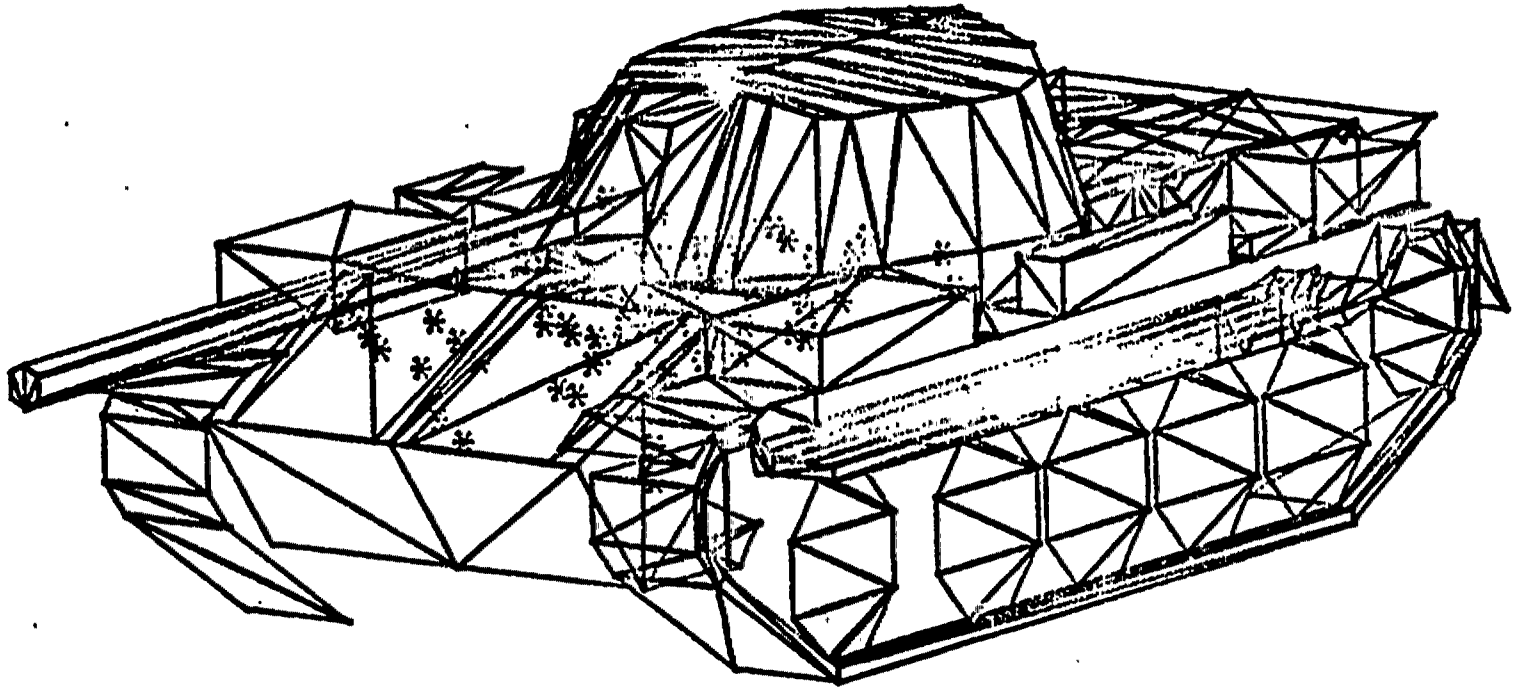
RANK	DEVIATE
0.05	26.27
0.10	32.21
0.15	33.85
0.20	37.74
0.25	41.80
0.30	47.52
0.35	51.76
0.40	59.07
0.45	65.33
0.50	66.43
0.55	67.95
0.60	68.74
0.65	69.73
0.70	71.91
0.75	73.08
0.80	78.93
0.85	82.34
0.90	86.58
0.95	88.57

LOFAC COMPARISON WITH ZOT.14 RUN 530

FACET NO.	NO. OF IMPACTS
136	16
-136	5
178	5
182	4
231	4
135	3
171	3
232	3
238	3
242	3
-231	2
142	2
240	2
244	2
270	2
274	2
287	2
-232	1
65	1
137	1
196	1
234	1
236	1
241	1
246	1
253	1
275	1
277	1
278	1
283	1
286	1
288	1


LOFAC COMPARISON WITH ZOT.14 RUN 530
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 79.2 PHI = 36.0
SCALE: X = -250 TO 50
Y = -90 TO 110



LOFAC COMPARISON WITH ZOT.14 RUN 530

LOFAC COMPARISON WITH ZOT.14 RUN 531

THERE WERE 3 MISSES

THEY WERE REPS #: 13 45 50

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

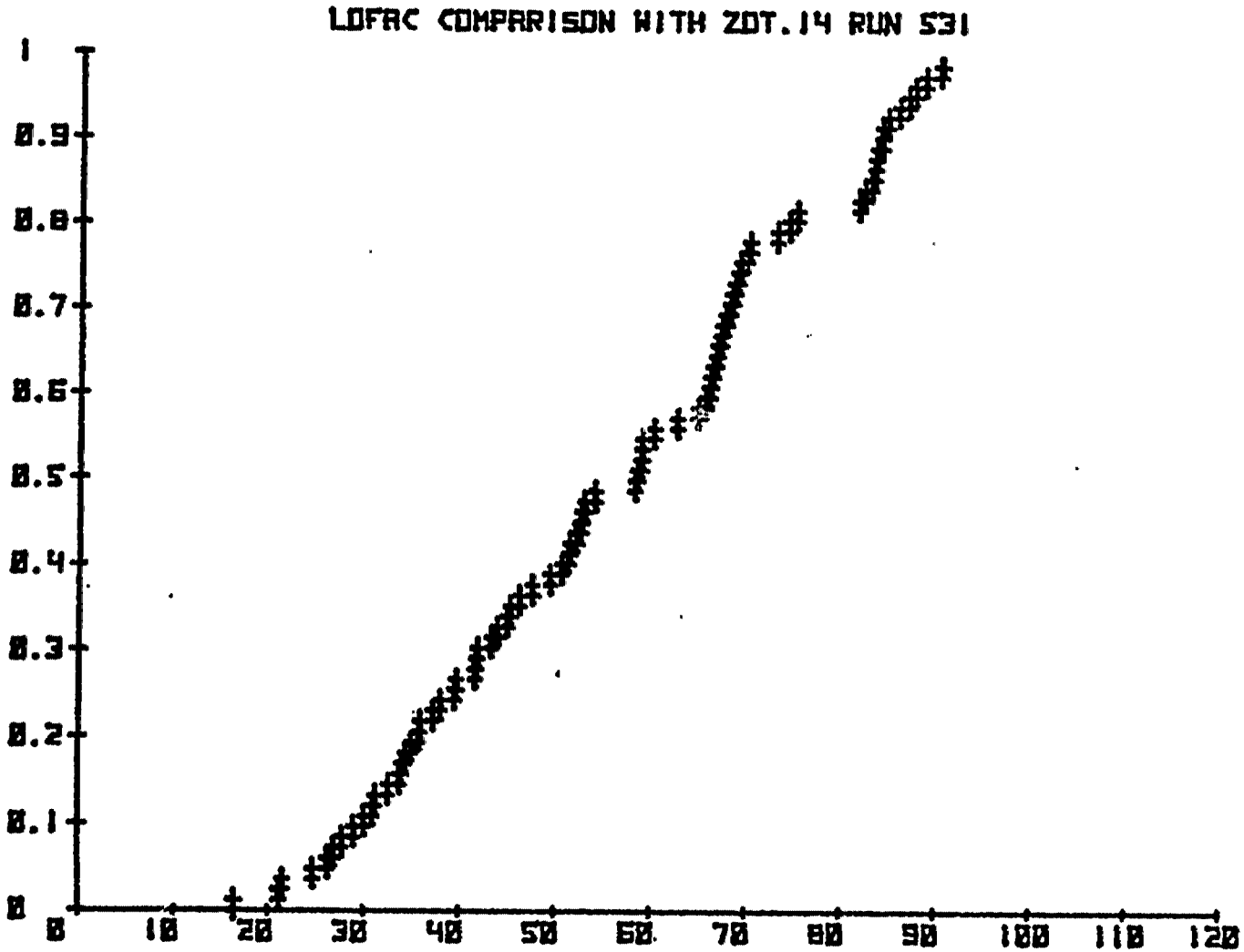
35	16.4575	54	35.9999	43	51.5772	59	66.5223	14	82.4093
36	21.1485	70	37.3488	80	52.2368	19	66.8165	57	83.0643
72	21.5371	71	38.0965	69	52.6513	68	66.9469	73	83.4381
62	24.7720	81	39.5833	16	52.7982	3	67.2838	8	83.5368
49	26.2977	25	39.7470	44	53.1215	28	67.4249	39	83.6516
58	26.9702	55	41.6877	47	54.2149	2	67.8337	75	84.2116
66	27.8445	29	41.8524	83	58.3834	6	68.2722	65	84.2198
15	29.0772	40	41.9586	26	58.5945	82	68.4436	10	84.8142
11	30.1465	63	43.4085	24	59.0159	60	68.7509	27	86.0001
56	31.0436	38	44.0321	1	59.0817	64	69.0846	12	86.9772
74	31.3199	34	45.0130	85	59.1341	51	69.3926	20	87.6904
41	32.6834	7	45.3663	52	60.3702	4	69.9636	31	88.7549
61	33.8141	32	46.3312	46	62.7833	9	70.3517	22	90.3821
78	34.0769	5	47.6360	42	64.9740	17	73.2424	79	90.5457
21	34.4460	18	49.5403	33	65.7147	48	74.4627		
84	35.0835	53	50.7099	23	66.1015	77	75.3085		
76	35.8299	67	51.4326	30	66.2815	37	81.8725		

OBLIQUITY MEAN 56.3536 DEG, STANDARD DEVIATION 20.0413 DEG

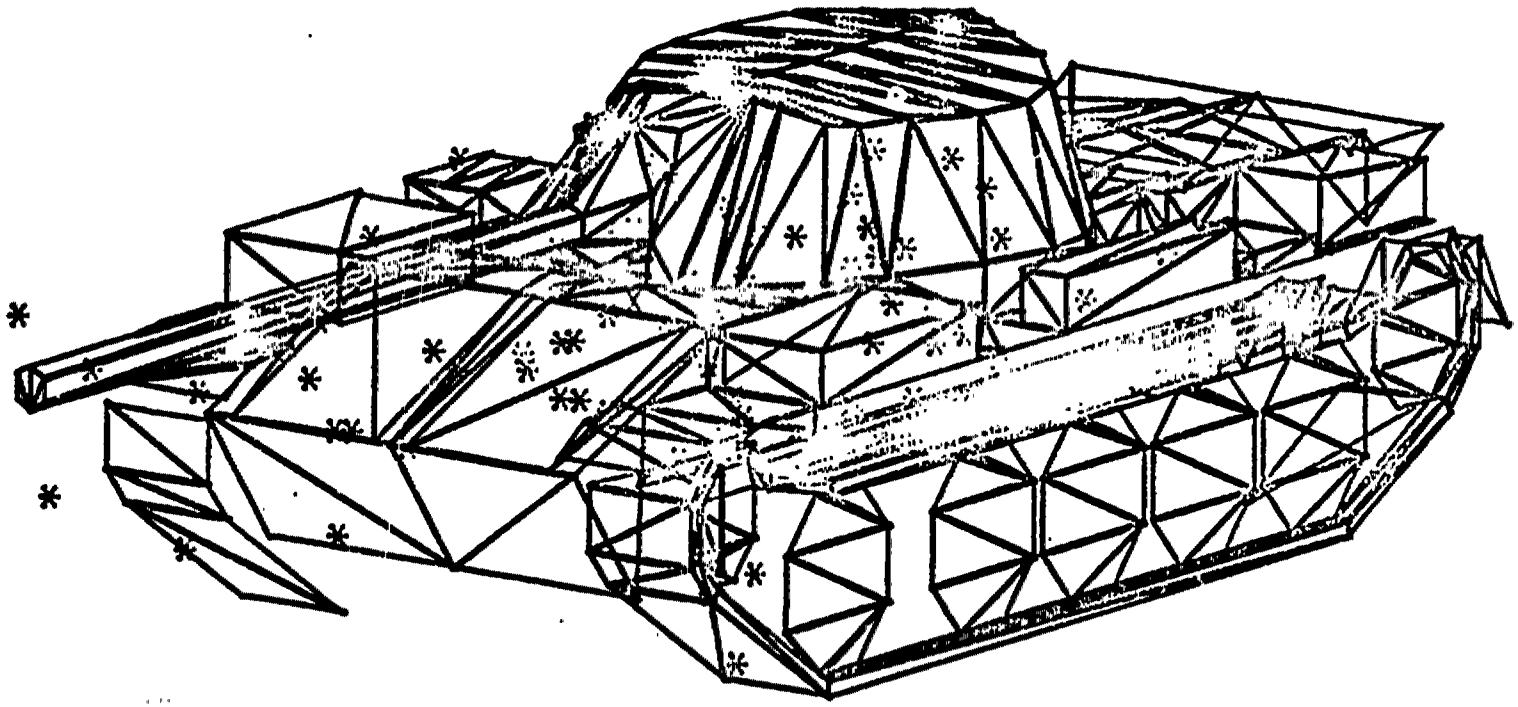
PERCENTILES:

RANK	DEVIATE
0.05	25.00
0.10	29.40
0.15	33.19
0.20	35.53
0.25	39.21
0.30	41.95
0.35	45.41
0.40	50.85
0.45	52.70
0.50	58.49
0.55	59.94
0.60	66.02
0.65	66.94
0.70	68.29
0.75	69.54
0.80	74.80
0.85	83.27
0.90	84.22
0.95	87.58

FACET NO.	NO. OF IMPACTS
136	8
244	5
-136	4
10	4
179	4
287	4
144	3
146	3
178	3
231	3
238	3
284	3
184	2
242	2
248	2
272	2
286	2
288	2
-280	1
-198	1
-144	1
-142	1
-137	1
-135	1
-134	1
-68	1
34	1
45	1
46	1
65	1
68	1
134	1
142	1
182	1
193	1
235	1
241	1
245	1
246	1
247	1
253	1


LOFRC COMPARRISON WITH ZOT.14 RUN 531
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 78.4 PHI = 36.0
SCALE: X = -225 TO 75
Y = -90 TO 110



LOFAC COMPARISON WITH ZOT.14 RUN 531

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 532 PAGE 1

THERE WERE 16 MISSES

THEY WERE REPS #: 1 4 10 13 14 24 26 30 35 40 43 45 50
52 64 85

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

46	17.5963	25	40.7395	7	56.0411	73	65.2715	2	90.6862
17	17.8683	38	40.7423	83	56.8933	8	65.9452		
19	19.4579	5	41.6315	80	57.1052	37	66.4554		
56	28.6682	9	41.6802	10	57.4461	60	67.2830		
51	29.5792	22	42.0796	20	58.4283	28	68.2252		
78	31.1586	70	42.2625	29	58.7241	57	69.2964		
61	31.8419	81	42.5741	79	59.0650	12	69.5897		
71	34.1627	67	43.0607	42	59.2330	23	70.0235		
76	34.1815	65	43.5561	53	62.1605	77	72.9118		
36	34.5390	33	45.1143	6	62.2710	27	75.8371		
41	35.4820	66	45.6982	49	62.3493	3	76.3373		
54	35.6347	44	45.8599	69	63.5498	74	76.5324		
11	35.7233	82	49.3514	72	64.6218	15	81.9007		
31	37.8308	59	50.8003	47	64.7494	34	83.4538		
75	39.4378	68	51.7382	58	65.0663	21	85.4737		
55	39.8944	16	52.2080	62	65.0687	48	85.5253		
63	40.0689	84	55.3153	39	65.1068	32	88.7969		

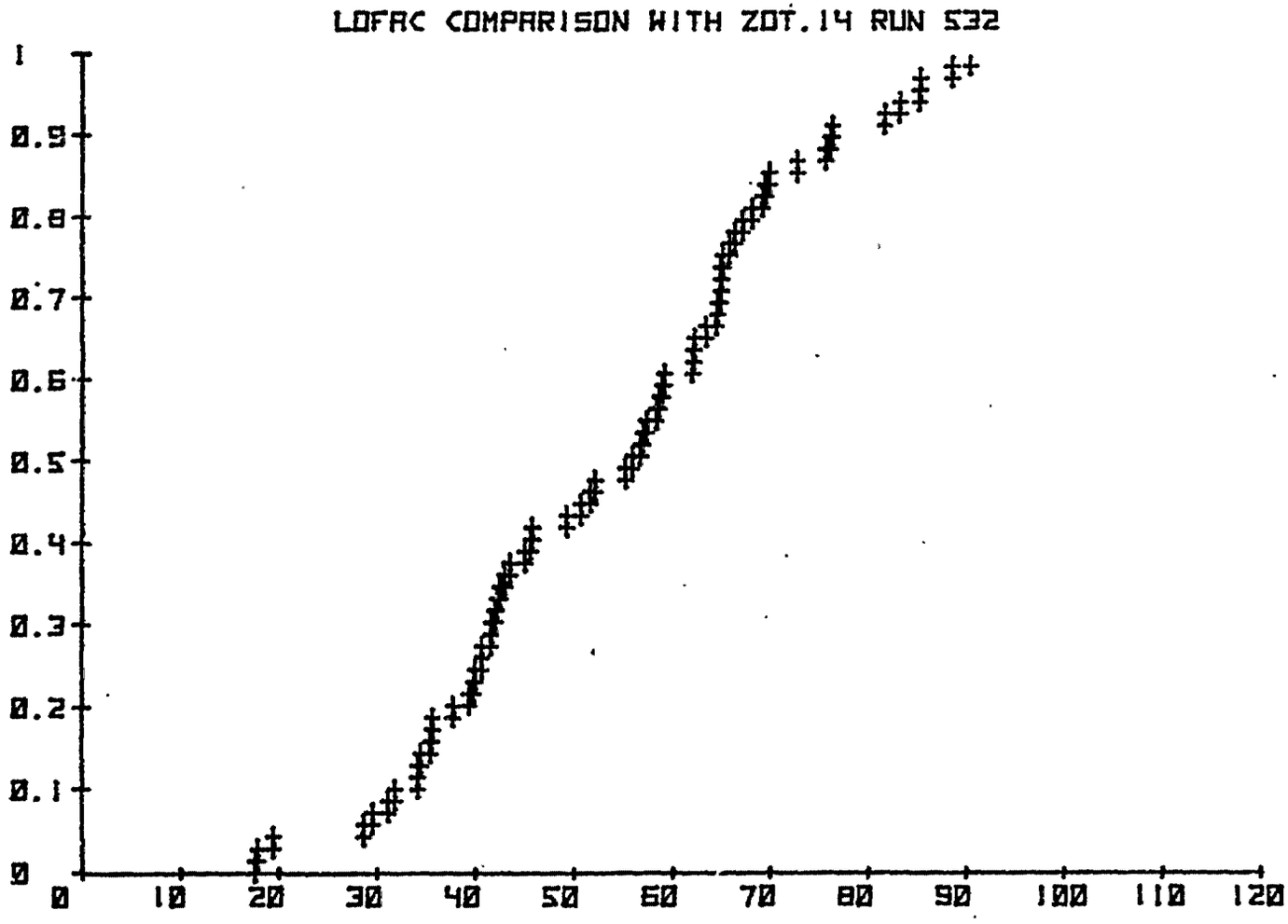
OBLIQUITY MEAN 53.8400 DEG, STANDARD DEVIATION 17.6809 DEG

PERCENTILES:

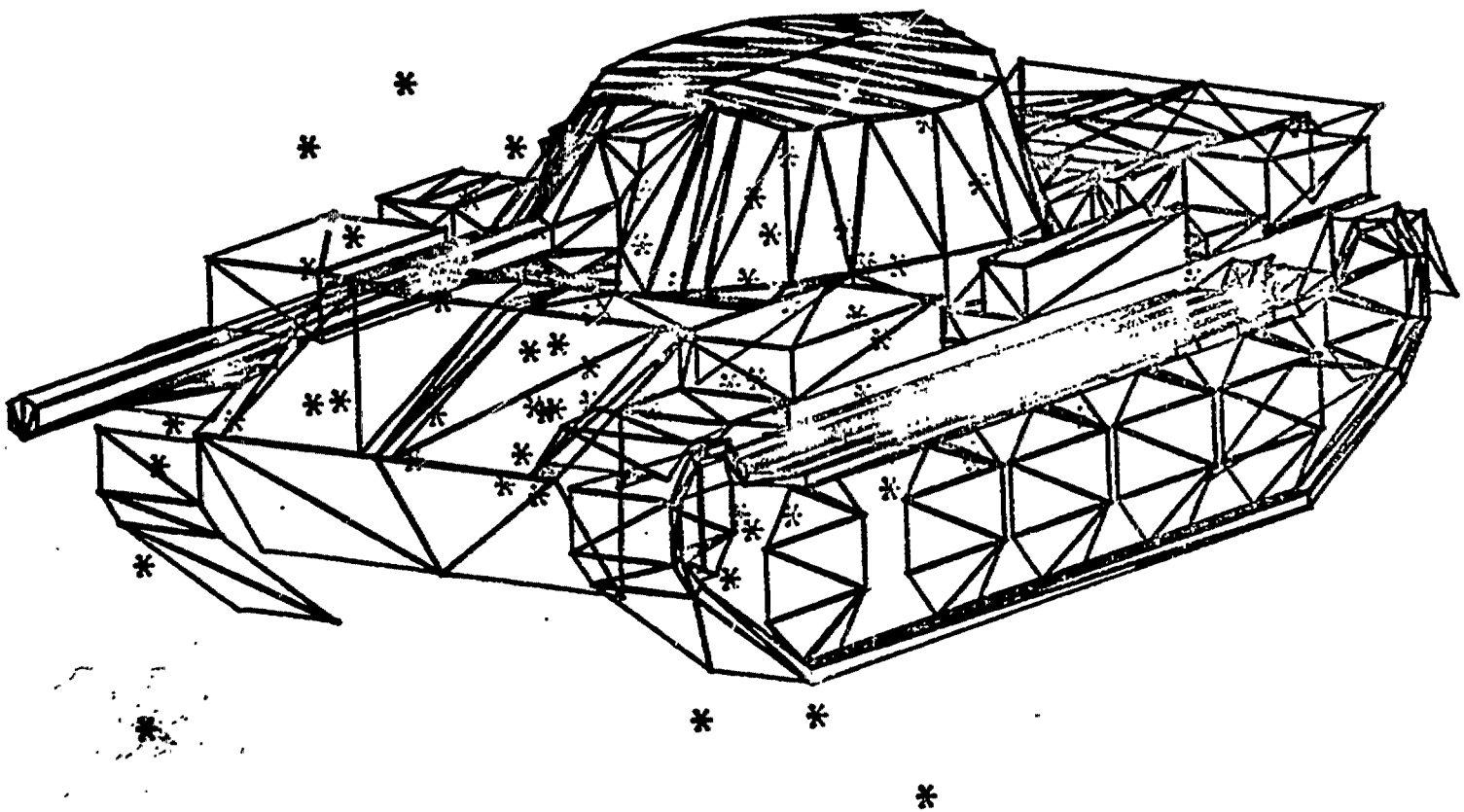
RANK	DEVIATE
0.05	24.06
0.10	31.84
0.15	35.01
0.20	37.83
0.25	40.40
0.30	41.68
0.35	42.82
0.40	45.70
0.45	51.27
0.50	56.04
0.55	57.94
0.60	59.23
0.65	62.95
0.70	65.07
0.75	65.61
0.80	68.23
0.85	71.47
0.90	76.53
0.95	85.50

LOFAC COMPARISON WITH 20T.14 RUN 532

FACET NO.	NO. OF IMPACTS
136	10
-136	3
135	3
242	3
286	3
125	2
134	2
146	2
178	2
182	2
193	2
199	2
246	2
287	2
-278	1
-273	1
-232	1
-137	1
-135	1
-66	1
-65	1
10	1
11	1
13	1
28	1
61	1
118	1
132	1
144	1
179	1
216	1
229	1
231	1
238	1
243	1
245	1
247	1
249	1
252	1
253	1
270	1
275	1
297	1


LOFRC COMPARISON WITH ZOT.14 RUN 532
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 78.0 PHI = 36.0
SCALE: X = -225 TO 75
Y = -90 TO 110



LOFRC COMPARISON WITH ZOT.14 RUN 532

THERE WERE 14 MISSES

THEY WERE REPS #: 1 10 15 24 26 30 40 43 45 53 54 66 82 85

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

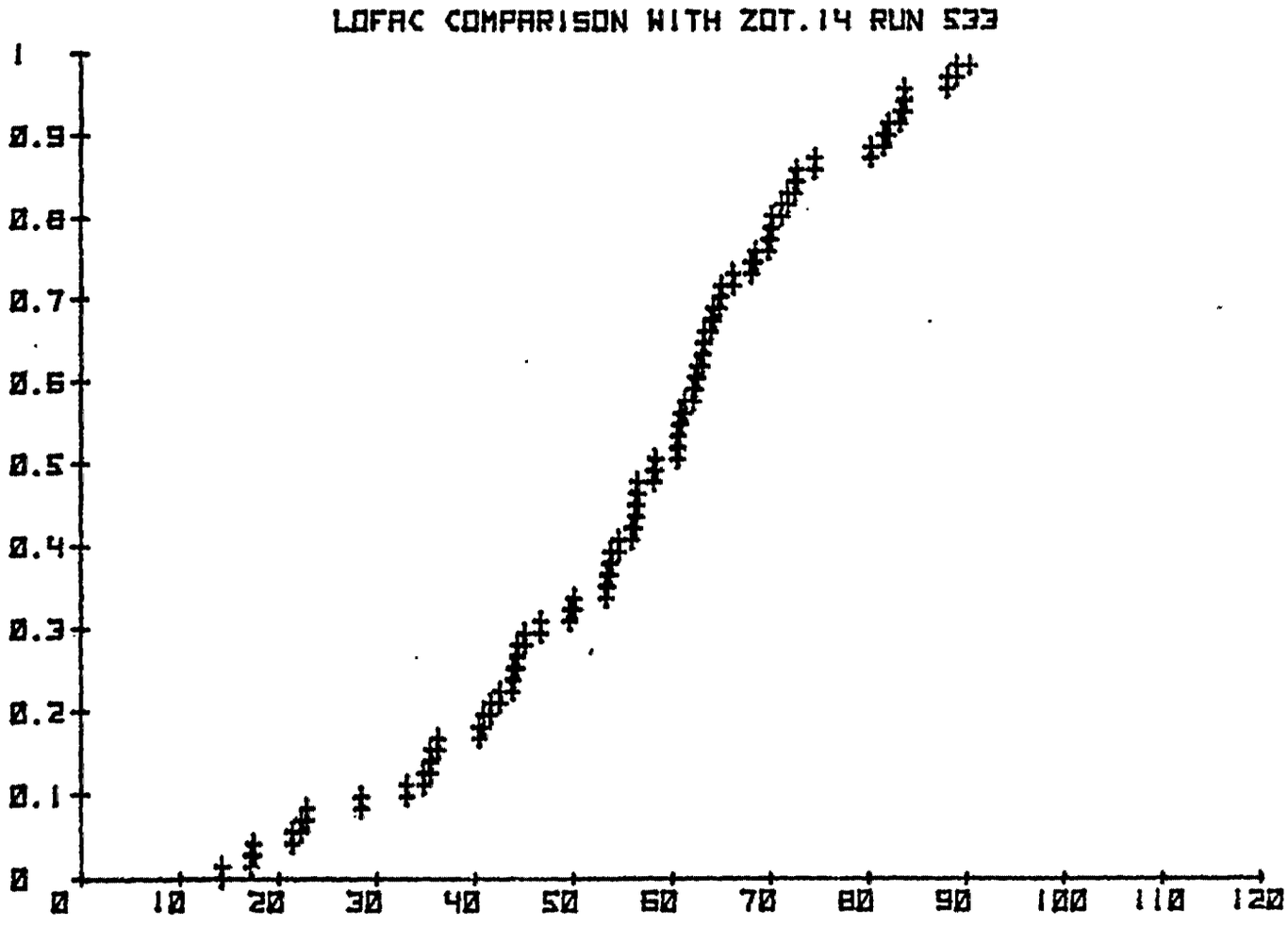
19	14.2525	2	43.9792	8	58.2643	20	66.3928	22	88.3299
64	17.2128	60	44.3612	73	58.4079	17	68.1998	32	89.2539
74	17.4700	65	44.4540	27	60.6620	55	68.6645	5	90.6724
78	21.4462	52	45.1565	14	60.7244	69	69.9843		
56	22.3631	47	46.7919	75	60.8288	23	70.2309		
38	22.8972	11	49.7317	39	61.0027	77	70.3621		
41	28.4490	79	50.2099	62	61.5027	3	71.3532		
67	33.1126	42	53.4252	58	62.2956	51	71.9460		
31	34.6657	9	53.5396	6	62.5016	25	72.6469		
12	35.5367	59	53.8490	72	62.7576	61	72.8970		
48	35.5702	70	53.9122	49	63.2420	76	74.7614		
63	36.2807	28	54.7099	35	63.3297	18	80.4389		
81	40.5075	57	56.0627	80	63.4878	34	81.7972		
36	40.9932	83	56.4031	44	64.1285	71	82.3178		
4	41.6717	68	56.4274	50	64.3999	21	83.4749		
46	42.6331	84	56.6091	16	65.0517	37	83.8911		
33	43.9171	7	56.6207	29	65.1969	13	83.9094		

OBLIQUITY MEAN 56.4047 DEG, STANDARD DEVIATION 18.3526 DEG

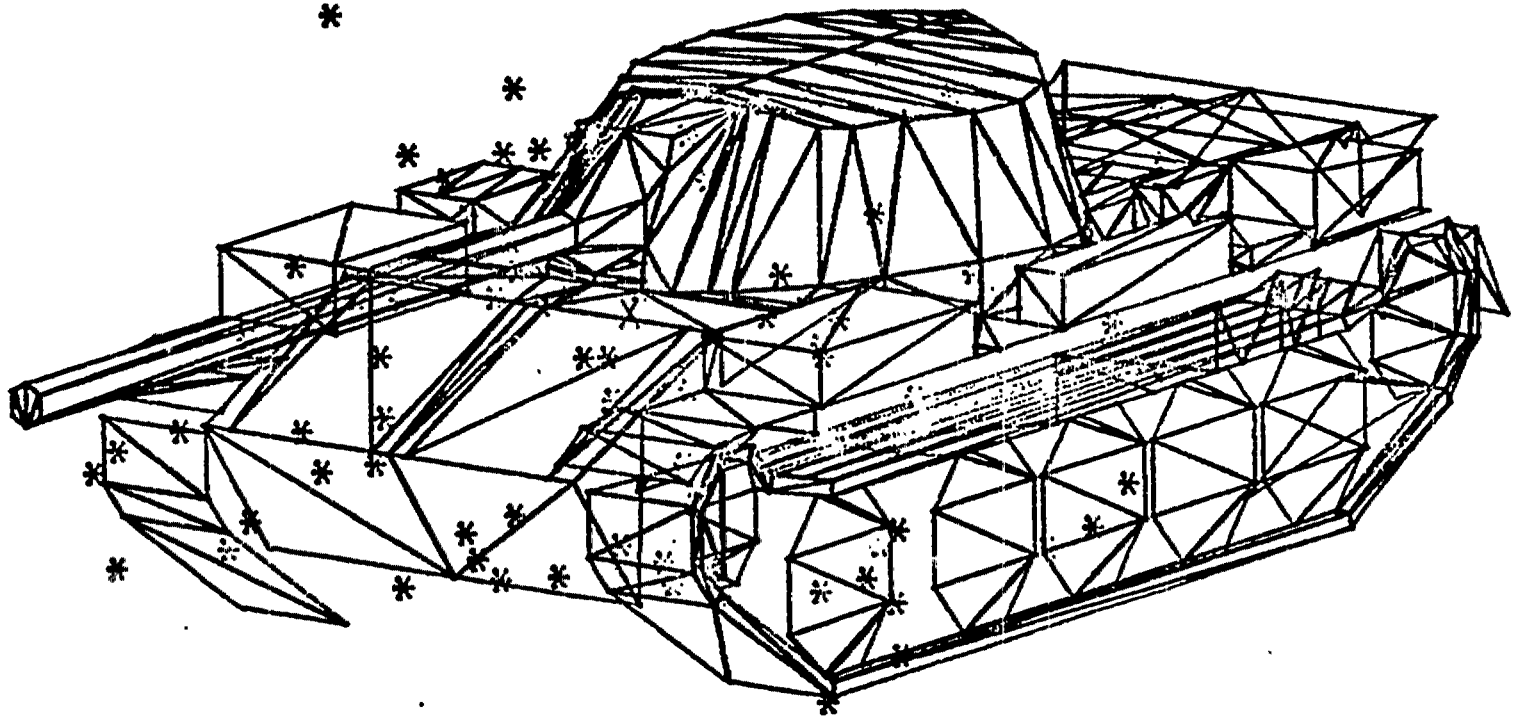
PERCENTILES:

RANK	DEVIATE
0.05	19.86
0.10	29.38
0.15	35.56
0.20	41.26
0.25	43.98
0.30	46.14
0.35	53.45
0.40	54.55
0.45	56.50
0.50	58.41
0.55	60.93
0.60	62.55
0.65	63.46
0.70	65.11
0.75	68.66
0.80	70.96
0.85	73.27
0.90	82.21
0.95	85.68

FACET NO.	NO. OF IMPACTS
134	5
129	4
136	4
-136	3
-134	3
115	3
178	3
287	3
-232	2
45	2
286	2
-231	1
-68	1
-66	1
-65	1
10	1
13	1
35	1
44	1
46	1
63	1
65	1
66	1
67	1
91	1
93	1
97	1
142	1
171	1
177	1
197	1
198	1
202	1
203	1
222	1
223	1
229	1
233	1
242	1
245	1
253	1
254	1
270	1
278	1
290	1
294	1
296	1
297	1


LOFAC COMPARISON WITH ZOT.14 RUN 533
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 77.6 PHI = 36.2
SCALE: X = -225 TO 75
Y = -90 TO 110



LOFAC COMPARISON WITH ZOT.14 RUN 533

LOFAC COMPARISON WITH ZOT.14 RUN 534

THERE WERE 0 MISSES

THEY WERE REPS #:

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

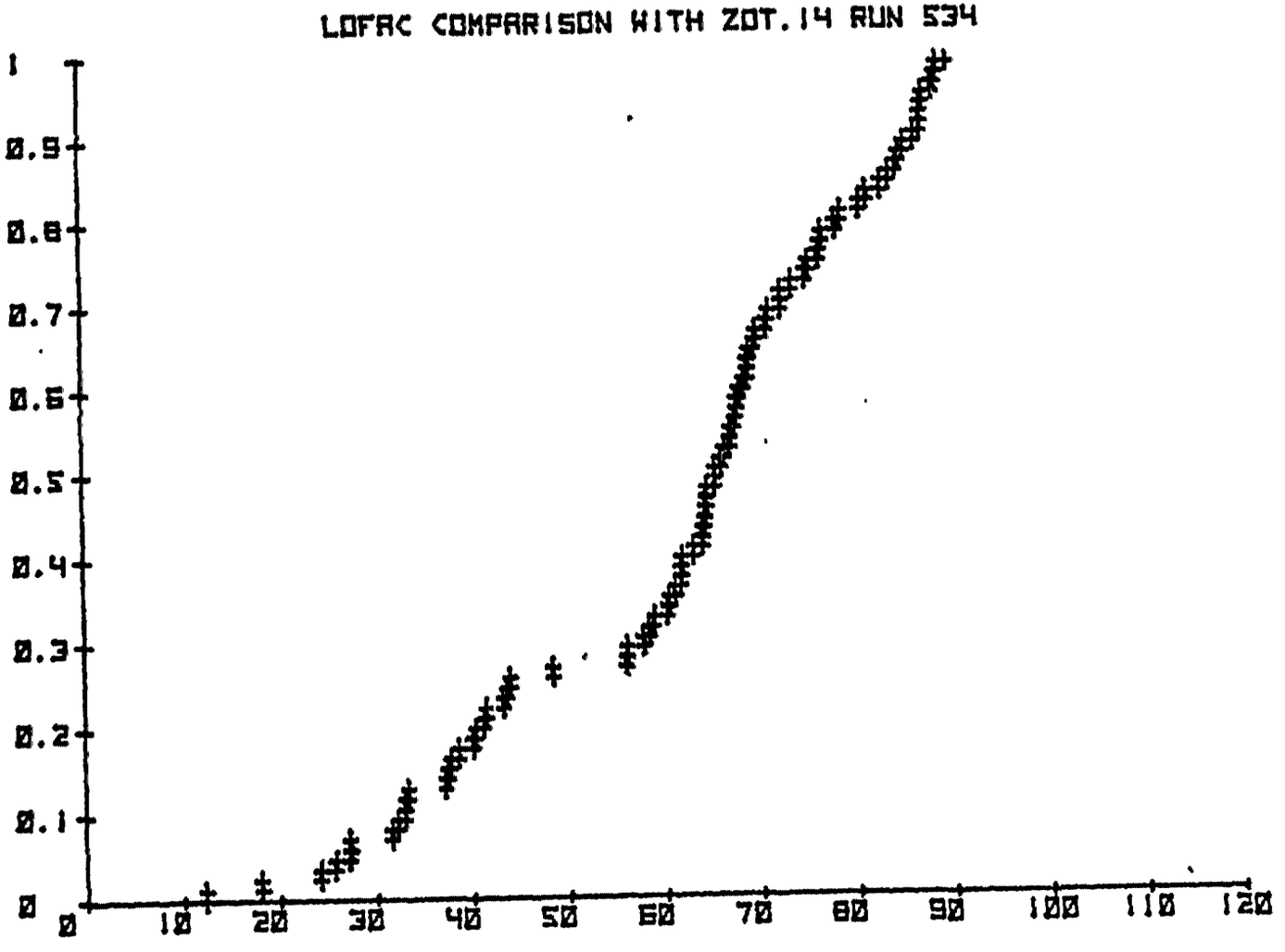
35	12.2912	69	41.2425	56	63.1392	28	68.5175	80	78.8357
78	18.0768	71	41.5064	64	64.0801	1	68.9037	11	80.8128
39	24.2466	18	43.2704	51	64.1343	32	68.9376	49	81.5848
70	25.7709	12	43.6072	6	64.3300	9	69.1268	41	83.0547
42	27.2361	59	43.9838	16	64.4289	26	69.6430	29	83.8961
74	27.2570	48	48.4755	17	64.5632	85	69.8528	45	84.6010
66	31.5993	53	56.1032	8	64.5770	27	70.9587	81	84.9563
84	32.2738	75	56.1363	50	65.4346	4	71.1646	34	85.4514
61	33.0104	79	57.8420	82	65.4471	52	72.4565	60	86.5145
7	33.0594	83	58.4515	40	66.0348	14	72.4685	43	87.1061
76	33.3639	47	58.9683	10	66.4604	36	73.6263	63	87.1598
21	37.2567	44	60.3391	55	67.0277	30	75.0623	20	87.2113
38	37.5015	3	60.5694	2	67.1522	57	75.4081	54	87.4125
67	37.8031	19	61 2750	68	67.5762	73	76.4571	5	88.4803
15	38.6416	24	61.8348	46	67.7359	58	76.6130	22	88.7585
65	40.0929	33	61.8476	23	67.7808	62	76.8268	31	88.9497
25	40.4051	37	61.9558	13	68.0706	77	78.2887	72	90.0036

OBLIQUITY MEAN 61.2161 DEG, STANDARD DEVIATION 19.2967 DEG

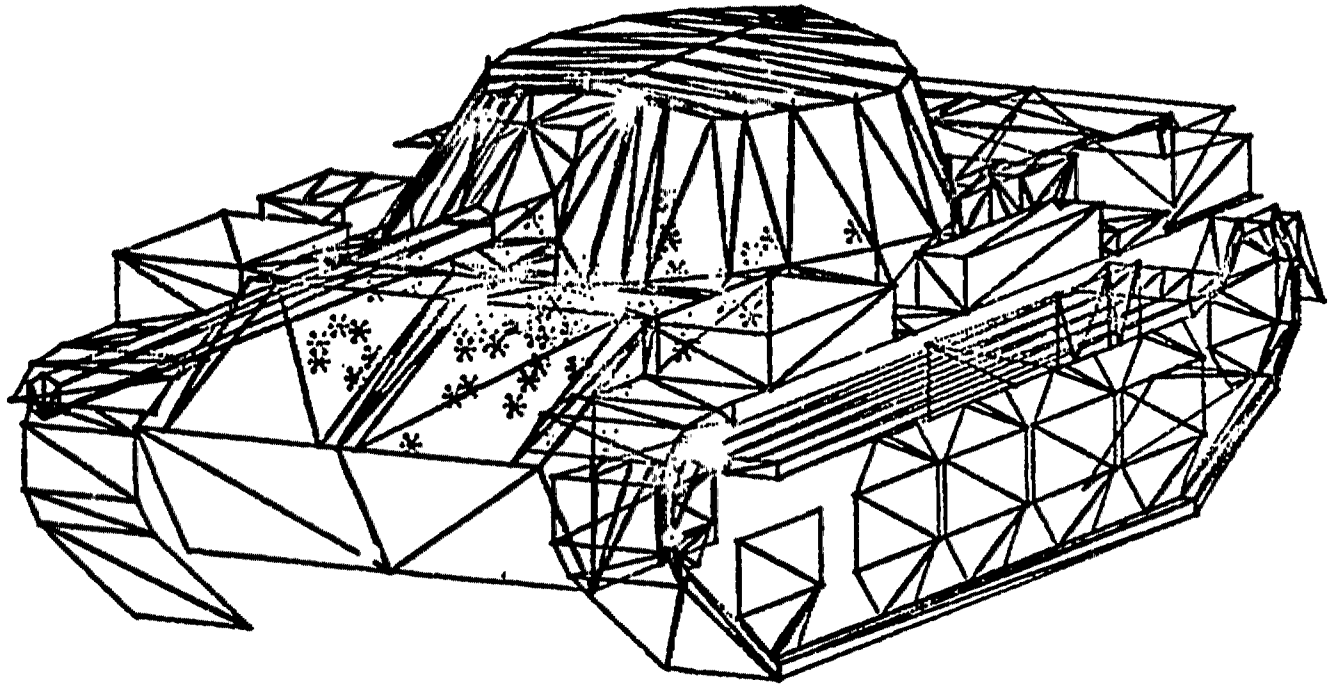
PERCENTILES:

RANK	DEVIATE
0.05	26.21
0.10	32.72
0.15	37.48
0.20	40.57
0.25	43.80
0.30	57.50
0.35	60.64
0.40	62.43
0.45	64.40
0.50	65.45
0.55	67.28
0.60	68.34
0.65	69.59
0.70	72.46
0.75	75.93
0.80	78.73
0.85	83.97
0.90	86.75
0.95	88.16

FACET NO.	NO. OF IMPACTS
136	22
231	12
-136	6
178	4
242	4
232	3
240	3
241	3
142	2
171	2
182	2
244	2
274	2
284	2
285	2
287	2
-278	1
-235	1
-231	1
32	1
135	1
137	1
233	1
246	1
270	1
277	1
278	1
288	1


LOFAC COMPARISON WITH ZOT.14 RUN 534
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 79.1 PHI = 28.3
SCALE: X = -225 TO 75
Y = -90 TO 110



LOFAC COMPARISON WITH ZOT.14 RUN 534

THERE WERE 4 MISSES

THEY WERE REPS #: 1 24 50 73

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

57	16.4870	26	41.4665	70	59.0603	23	69.8911	41	82.6680
45	20.1578	20	43.5331	43	59.7354	28	69.9003	65	84.4177
58	28.4642	29	48.5516	42	60.6465	9	70.0077	10	84.6811
61	29.8258	44	49.2154	52	63.9772	21	70.3042	62	84.7936
74	30.1018	19	49.8684	13	64.4149	62	70.3625	81	85.9501
49	31.8163	33	50.7115	53	64.6046	27	71.2382	60	86.2972
75	32.2592	40	51.9990	18	65.1029	3	72.0686	22	88.2453
78	32.7756	47	52.0203	31	65.6409	39	73.1289	5	89.7287
38	33.4327	79	52.6797	46	66.6412	77	73.1829	7	91.9200
36	34.5336	68	52.7255	16	66.7897	37	73.2929		
25	35.0870	69	53.3383	51	66.8803	80	74.4503		
66	35.3792	4	54.9761	30	67.1923	11	75.9021		
34	35.4454	55	55.0656	54	67.5655	48	76.3250		
76	36.0899	56	55.4678	2	67.6781	67	77.4193		
71	37.9218	72	55.6903	32	68.1280	6	80.2624		
35	40.4489	17	57.3015	14	68.2827	8	81.0118		
15	40.5461	64	58.1403	12	69.4244	59	82.1044		

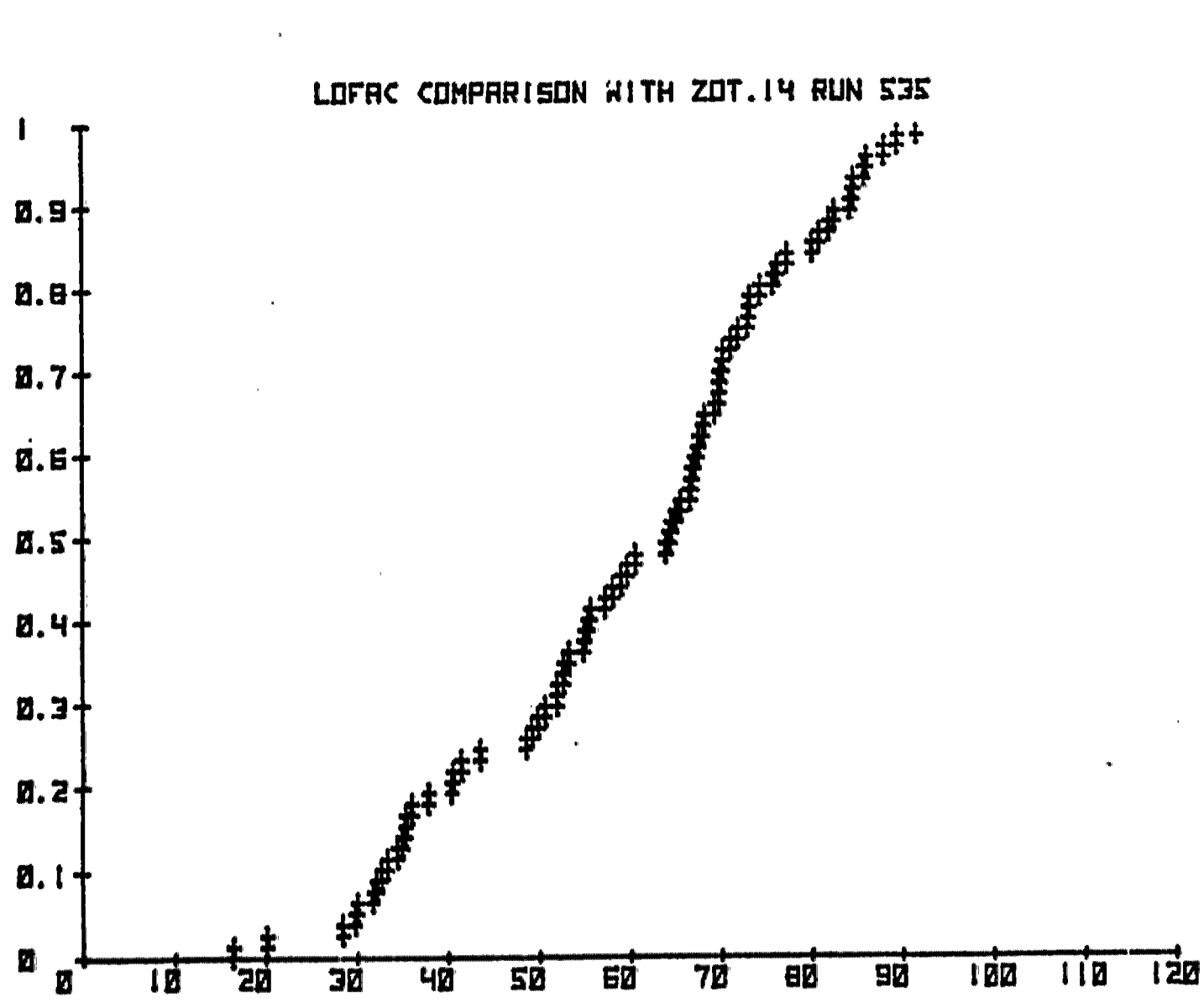
OBLIQUITY MEAN 59.5434 DEG; STANDARD DEVIATION. 18.3971 DEG

PERCENTILES:

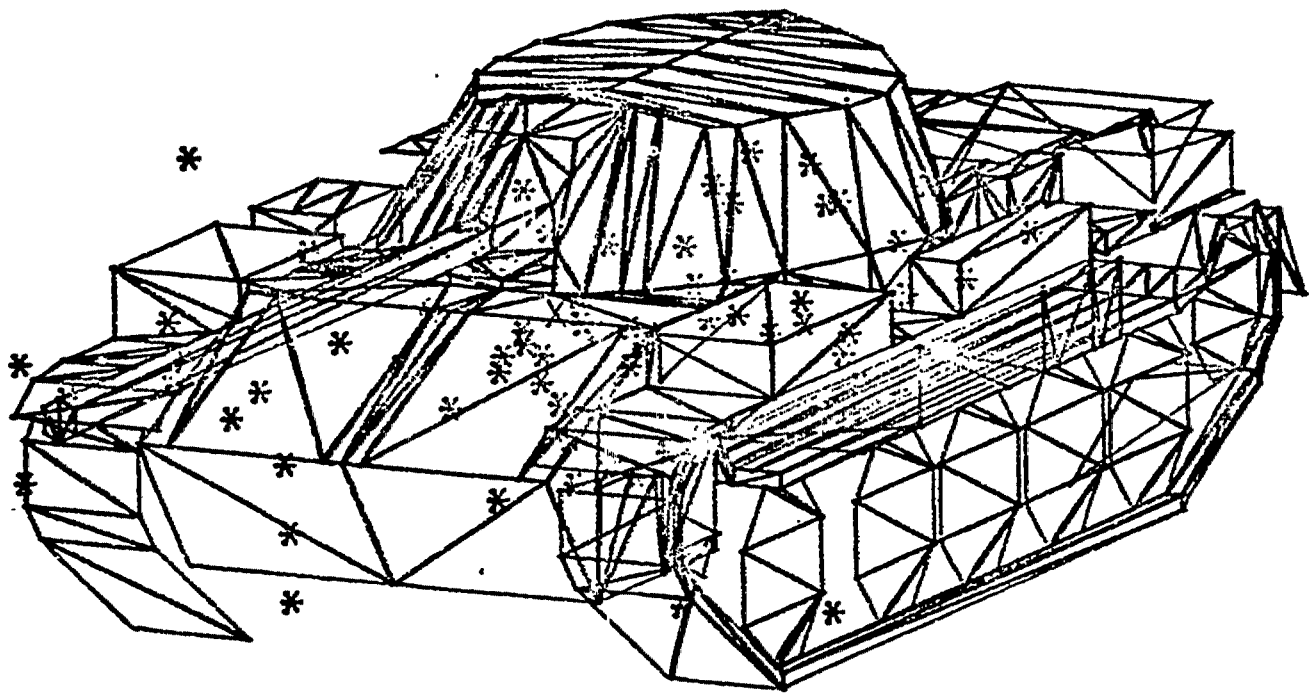
RANK	DEVIATE
0.05	29.69
0.10	32.67
0.15	35.29
0.20	39.44
0.25	46.04
0.30	51.23
0.35	52.91
0.40	55.51
0.45	59.13
0.50	64.41
0.55	66.54
0.60	67.49
0.65	69.08
0.70	70.19
0.75	72.60
0.80	75.03
0.85	80.49
0.90	84.47
0.95	86.49

LOFAC COMPARISON WITH ZOT.14 RUN 535

FACET NO.	NO. OF IMPACTS
136	9
178	5
142	4
-136	3
47	3
231	3
242	3
286	3
-231	2
-134	2
135	2
177	2
179	2
244	2
246	2
254	2
284	2
285	2
287	2
-290	1
-280	1
-242	1
-142	1
-137	1
-66	1
64	1
68	1
134	1
144	1
171	1
183	1
184	1
193	1
197	1
235	1
238	1
245	1
247	1
248	1
250	1
283	1


LOFAC COMPARISON WITH ZOT.14 RUN 535
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 78.5 PHI = 27.2
SCALE: X = -225 TO 75
Y = -90 TO 110



LOFRC COMPARISON WITH ZOT.14 RUN 535

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 536 PAGE 1

THERE WERE 12 MISSES

THEY WERE REPS #: 1 13 16 24 40 45 50 53 57 64 65 73

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

35	5.8055	22	43.8057	80	56.7033	12	65.9883	3	85.6588
36	16.5116	34	45.4037	17	57.3570	27	67.1133	29	86.0046
48	19.7045	14	45.8103	11	57.4273	9	67.8817	18	86.6598
37	21.0071	5	45.9801	79	57.8021	26	67.9528	2	89.6185
84	28.7605	7	46.0001	51	58.6369	30	68.4068		
70	31.9051	4	46.4433	62	59.5269	6	68.5472		
61	32.0233	72	48.6717	42	59.7172	23	70.1826		
20	32.4451	52	48.8094	55	61.1388	39	72.3586		
15	33.2098	56	49.2733	82	62.0097	76	72.8236		
38	35.3094	43	49.3166	46	62.3421	75	73.2949		
71	37.2987	83	51.1614	66	62.5757	41	76.4554		
74	37.8735	77	51.3111	69	62.6001	31	77.9405		
58	38.2391	21	52.2649	32	64.1742	63	81.5742		
78	40.2635	19	53.3578	54	64.4784	59	82.0450		
25	40.3120	47	54.8944	44	64.6424	49	82.9613		
28	40.8303	10	56.2597	33	65.5438	60	83.7673		
81	42.3199	68	56.2681	67	65.7492	8	83.8823		

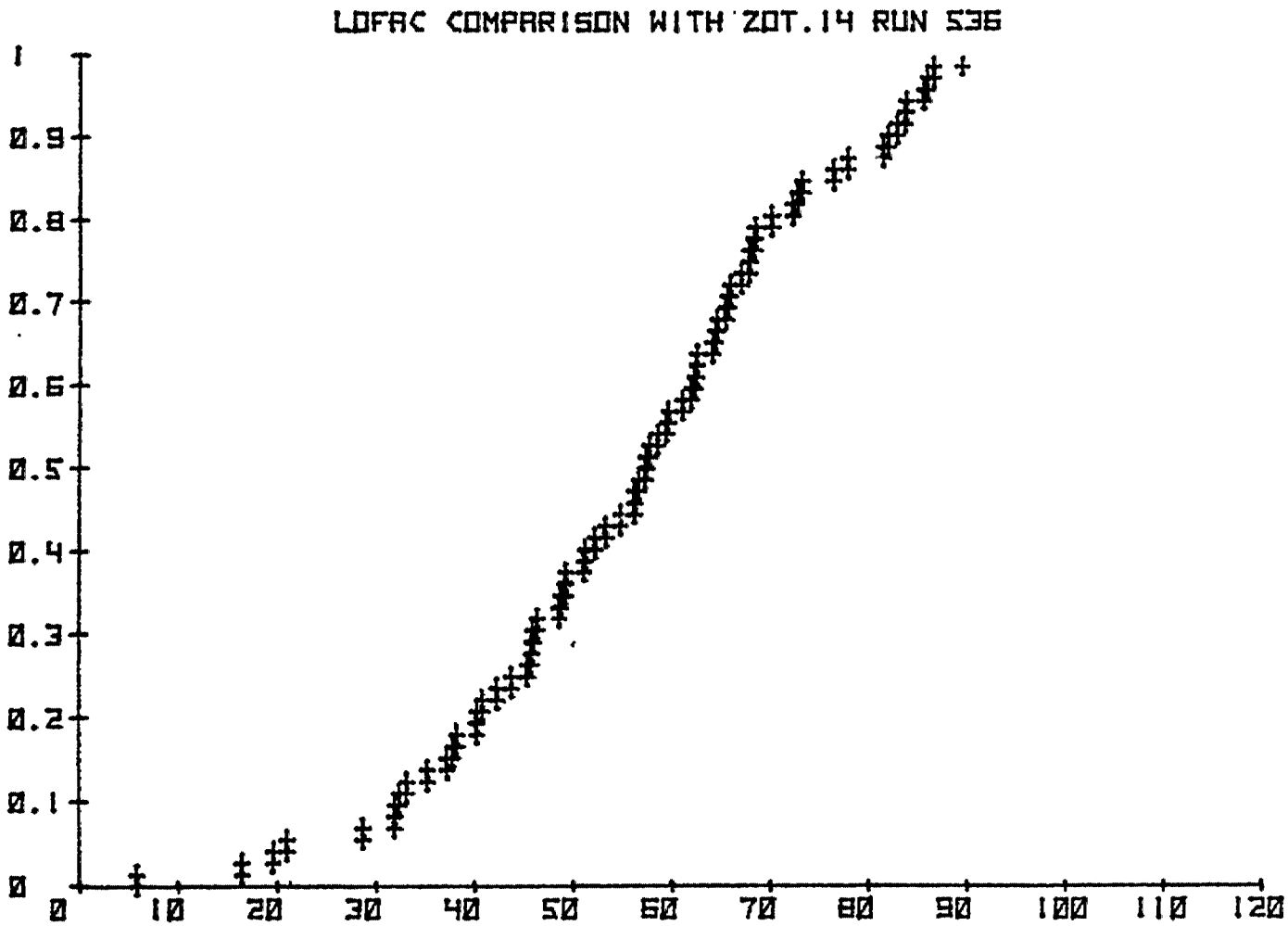
OBLIQUITY MEAN 56.0041 DEG, STANDARD DEVIATION 18.2718 DEG

PERCENTILES:

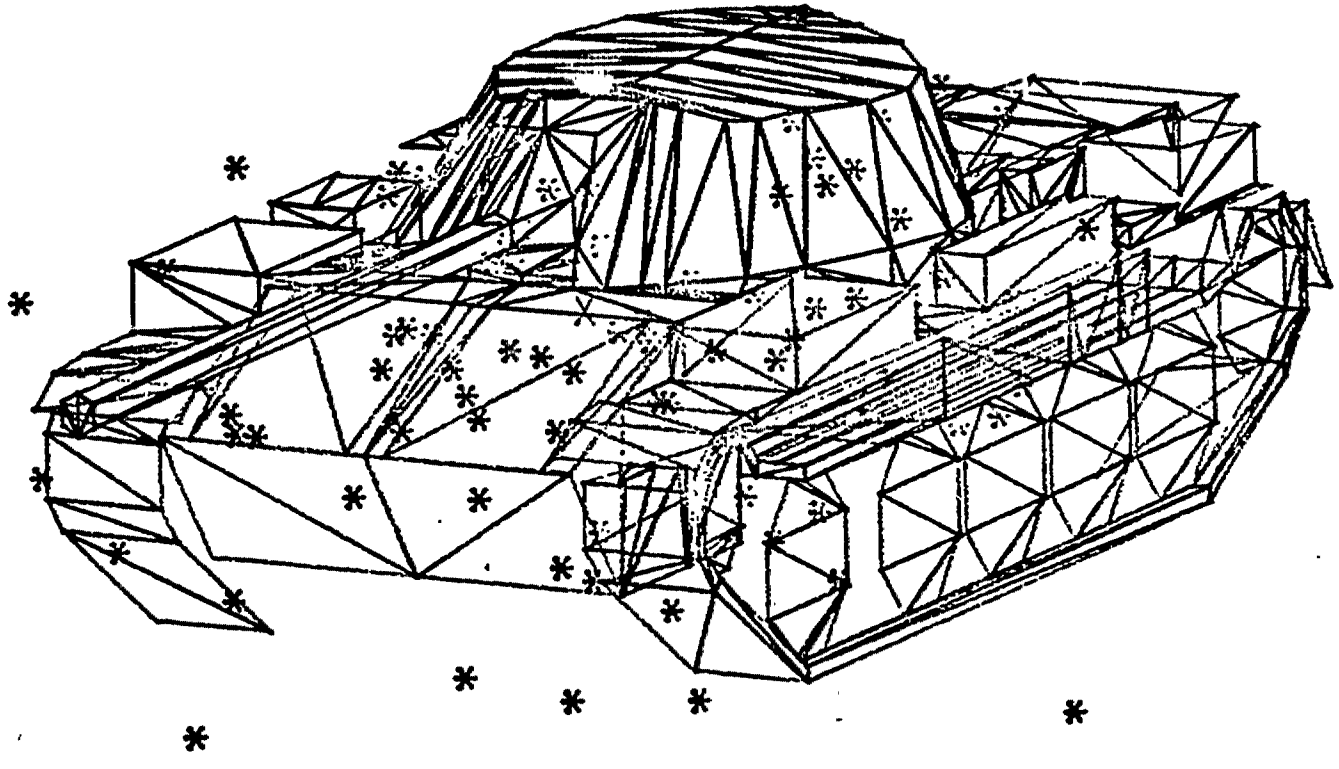
RANK	DEVIATE
0.05	20.55
0.10	32.15
0.15	37.20
0.20	40.29
0.25	44.21
0.30	45.99
0.35	49.06
0.40	51.50
0.45	56.05
0.50	57.39
0.55	59.56
0.60	62.28
0.65	64.31
0.70	65.77
0.75	67.94
0.80	71.05
0.85	76.53
0.90	82.69
0.95	85.78

LOFAC COMPARISON WITH ZOT.14 RUN 536

FACET NO.	NO. OF IMPACTS
-136	7
136	7
134	3
178	3
287	3
-68	2
28	2
129	2
137	2
146	2
182	2
184	2
187	2
212	2
246	2
248	2
273	2
-271	1
-223	1
-134	1
45	1
47	1
68	1
94	1
118	1
132	1
135	1
177	1
193	1
199	1
223	1
231	1
235	1
242	1
244	1
245	1
247	1
270	1
281	1
283	1
285	1
286	1


LOFRC COMPARISON WITH ZOT.14 RUN 536
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 78.2 PHI = 26.7
SCALE: X = -225 TO 75
Y = -90 TO 110



LOFRC COMPARISON WITH ZOT.14 RUN 536

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 537 PAGE 1

THERE WERE 16 MISSES

THEY WERE REPS #: 1 13 16 24 26 30 33 40 44 45 50 51 57
64 68 76

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

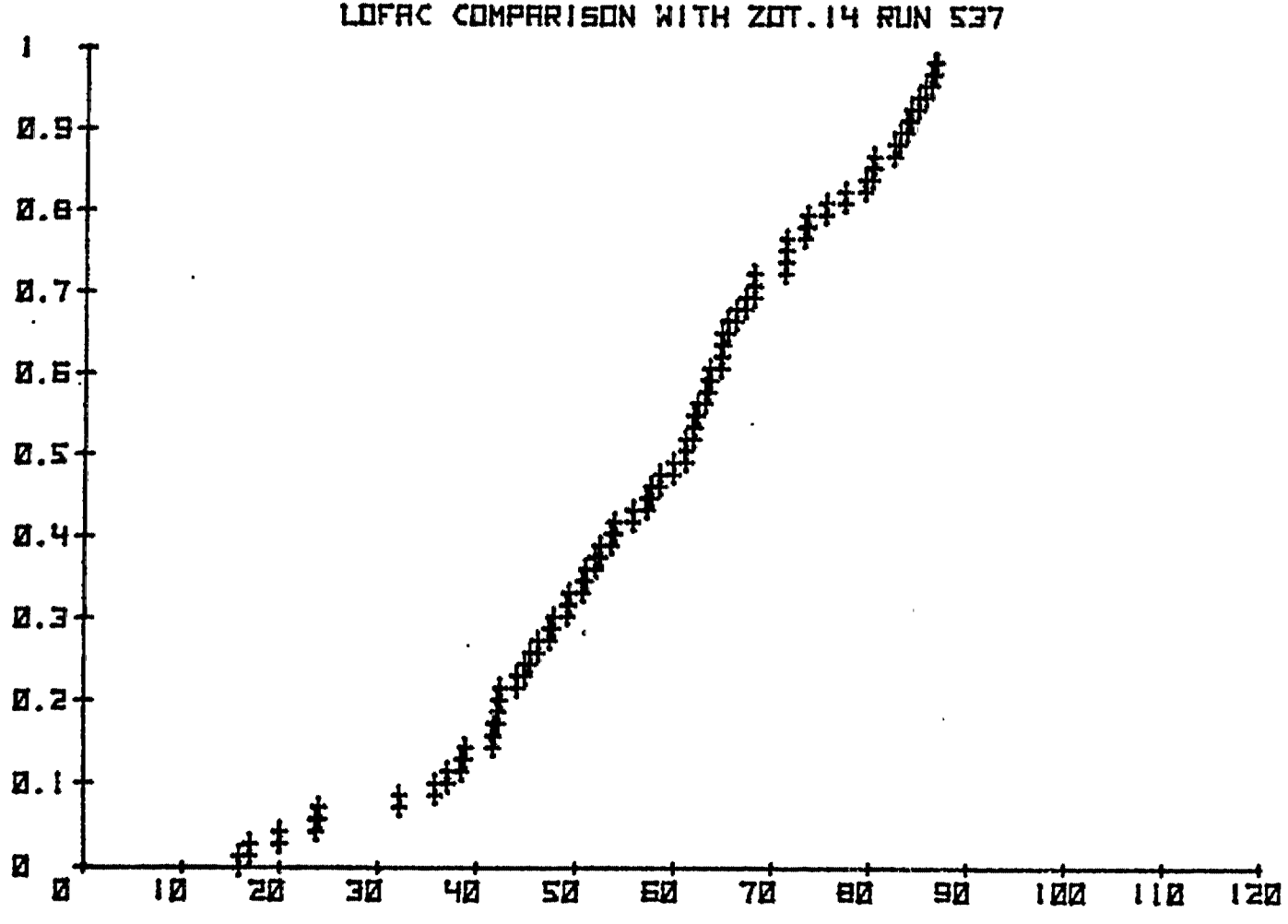
72	15.8772	56	45.4653	60	61.1155	59	71.2862	29	86.6309
3	16.9789	77	46.2687	17	61.1350	23	71.3786		
62	20.0160	14	47.3885	2	61.8851	6	73.2708		
25	23.7317	47	47.8194	61	61.9242	11	73.5286		
82	24.0068	52	49.1897	10	62.3162	53	75.4480		
35	32.2661	34	49.4060	12	63.1641	85	77.3706		
41	35.8762	46	50.7531	67	63.4068	69	79.4546		
71	37.1518	54	51.0488	83	63.5859	20	80.1613		
78	38.5609	55	52.0247	8	64.6941	70	80.2901		
19	38.9187	5	52.5004	58	64.7490	81	82.4021		
28	41.6690	49	53.6297	32	64.7807	66	82.9040		
39	41.7803	80	53.9225	43	65.3669	38	83.6715		
9	42.2042	79	55.8066	21	66.2173	37	84.0661		
84	42.2284	31	57.1968	15	67.1851	74	84.8016		
73	42.4207	63	57.6260	42	68.0352	36	85.5383		
27	44.1625	65	58.5195	48	68.0461	22	86.1431		
7	44.9343	4	59.8835	75	71.2522	18	86.4582		

OBLIQUITY MEAN 58.1869 DEG; STANDARD DEVIATION 18.1289 DEG

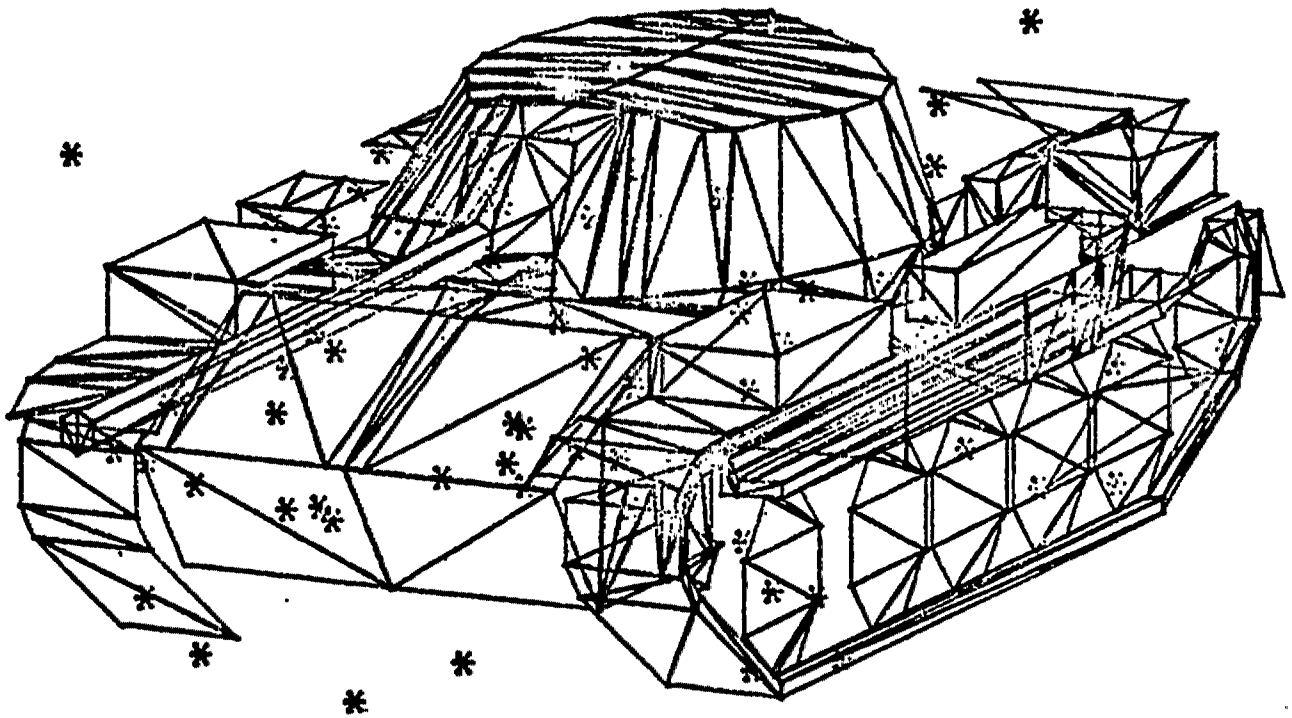
PERCENTILES:

RANK	DEVIATE
0.05	21.87
0.10	35.88
0.15	40.29
0.20	42.23
0.25	45.20
0.30	47.82
0.35	50.90
0.40	53.63
0.45	57.41
0.50	61.12
0.55	62.12
0.60	63.59
0.65	65.07
0.70	68.04
0.75	71.33
0.80	75.45
0.85	80.23
0.90	83.67
0.95	85.84

FACET NO.	NO. OF IMPACTS
136	6
-134	5
287	4
-136	3
142	3
-283	2
45	2
129	2
178	2
203	2
223	2
277	2
-280	1
-242	1
-239	1
-232	1
-68	1
-66	1
14	1
31	1
36	1
47	1
66	1
68	1
83	1
96	1
99	1
104	1
108	1
118	1
137	1
156	1
171	1
182	1
199	1
202	1
231	1
239	1
243	1
244	1
253	1
254	1
270	1
280	1
290	1
295	1


LOFAC COMPARISON WITH ZOT.14 RUN 537
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 77.7 PHI = 25.5
SCALE: X = -225 TO 75
Y = -90 TO 110



LOFAC COMPARISON WITH ZOT.14 RUN 537

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 538 PAGE 1

THERE WERE 6 MISSES

THEY WERE REPS #: 26 30 45 50 73 85

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

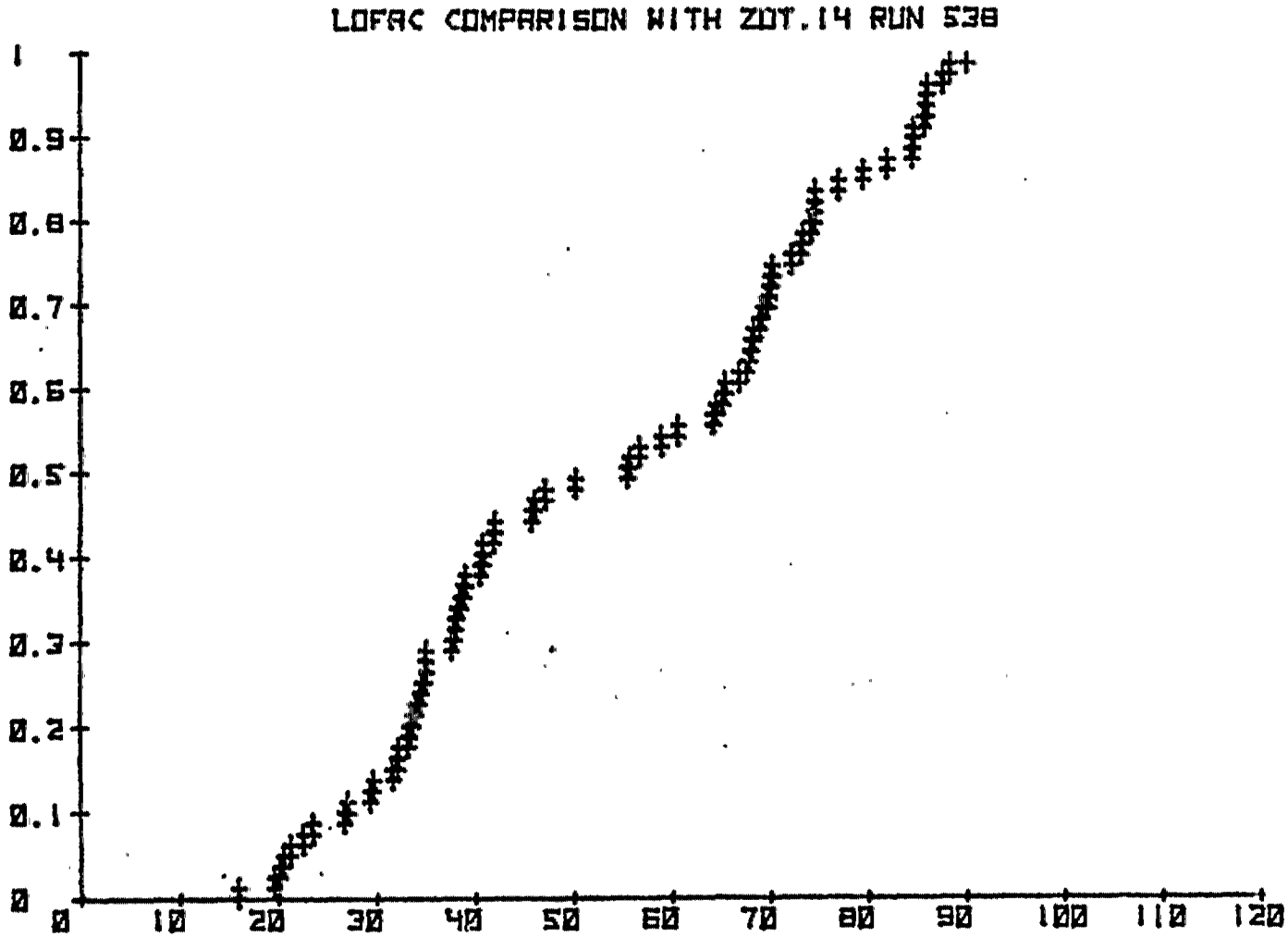
58	16.0047	32	34.0002	7	42.0373	68	68.1717	6	82.1022
35	19.6159	84	34.4396	48	45.8253	59	68.4735	55	84.6321
62	20.1596	74	34.6264	14	46.1584	47	69.0710	34	84.7699
72	20.5549	4	34.9964	53	47.2287	2	69.3800	65	84.7846
49	21.1936	25	35.0159	70	50.3159	28	69.8822	79	85.8474
8	22.5289	78	35.0622	44	55.5702	43	70.0523	20	86.1371
66	23.5119	75	37.6963	16	55.8032	82	70.2054	27	86.1399
38	26.7414	39	37.9828	33	56.7757	60	70.3590	9	86.2243
12	27.0568	21	38.0066	83	58.9966	1	72.3451	10	87.8502
81	29.3495	63	38.2096	64	60.6894	23	73.3011	31	88.5270
61	29.6854	36	38.5786	19	64.2923	40	73.4703	22	90.3019
37	31.6383	71	38.8893	15	64.5866	3	74.2884		
29	32.1817	80	39.0871	46	65.2	56	74.6588		
41	32.2249	67	40.6138	69	65.51.	17	74.6830		
52	33.2120	24	40.8807	42	66.9349	54	74.7347		
11	33.3470	5	40.8898	13	67.7584	77	77.0810		
18	33.6659	76	41.9830	51	68.0220	57	79.6184		

OBLIQUITY MEAN 53.8288 DEG, STANDARD DEVIAT ON 21.6688 DEG

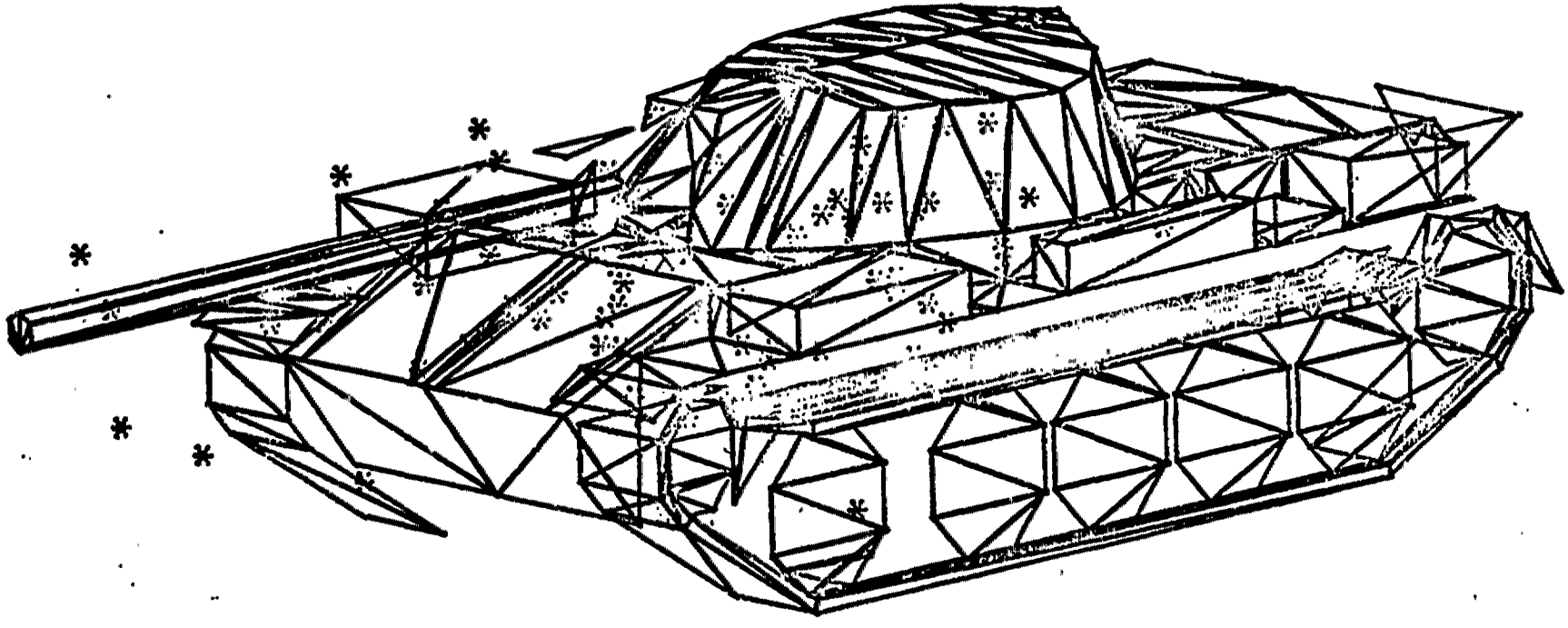
PERCENTILES:

RANK	DEVIATE
0.05	20.55
0.10	26.74
0.15	31.64
0.20	33.35
0.25	34.63
0.30	37.70
0.35	38.58
0.40	40.88
0.45	45.83
0.50	55.57
0.55	60.69
0.60	65.52
0.65	68.17
0.70	69.88
0.75	72.35
0.80	74.66
0.85	79.62
0.90	84.78
0.95	86.22

FALET NO.	NO. OF IMPACTS
136	7
179	4
242	4
287	4
146	3
171	3
178	3
-137	2
-136	2
231	2
234	2
243	2
244	2
246	2
247	2
270	2
288	2
-271	1
-146	1
-144	1
-142	1
-135	1
-68	1
8	1
11	1
46	1
67	1
68	1
95	1
129	1
135	1
137	1
144	1
156	1
177	1
182	1
184	1
196	1
202	1
240	1
241	1
245	1
248	1
253	1
275	1
282	1
284	1
286	1


LOFAC COMPARISON WITH ZOT.14 RUN 538
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 78.0 PHI = 46.6
SCALE: X = -265 TO 35
Y = -90 TO 110



LOFAC COMPARISON WITH ZOT.14 RUN 538

THERE WERE 14 MISSES

THEY WERE REPS #: 1 7 10 13 16 24 26 30 40 43 45 50 52 85

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

37	21.7469	49	37.8298	82	53.7547	19	67.5495	48	87.1510
66	25.2955	14	37.8989	4	54.0345	73	68.0826	3	88.0750
46	26.2590	9	38.1335	35	54.5013	25	68.7652	5	90.0093
31	28.8561	70	38.3985	39	56.4575	2	70.2540		
55	29.6742	15	39.0789	64	56.6456	17	70.2706		
62	30.7809	22	39.3595	51	59.0052	56	70.3027		
41	31.1806	84	41.4923	20	61.2246	60	70.3334		
11	31.5880	34	41.7882	69	61.3497	23	72.2205		
78	31.7247	36	42.7555	57	62.1679	28	73.6734		
58	32.2416	8	45.0645	72	62.4261	61	74.5016		
81	32.6764	79	47.5263	53	63.1035	77	75.2273		
38	33.2384	44	48.1243	74	63.2037	6	75.7761		
76	33.3537	75	48.2533	42	63.2276	27	78.6432		
18	34.1184	33	48.9698	29	63.7227	71	80.5524		
65	34.5154	80	49.3954	47	64.8082	54	82.3030		
63	34.9365	83	51.2023	59	65.3426	21	86.1646		
67	36.8927	32	52.9044	68	66.8003	12	86.4156		

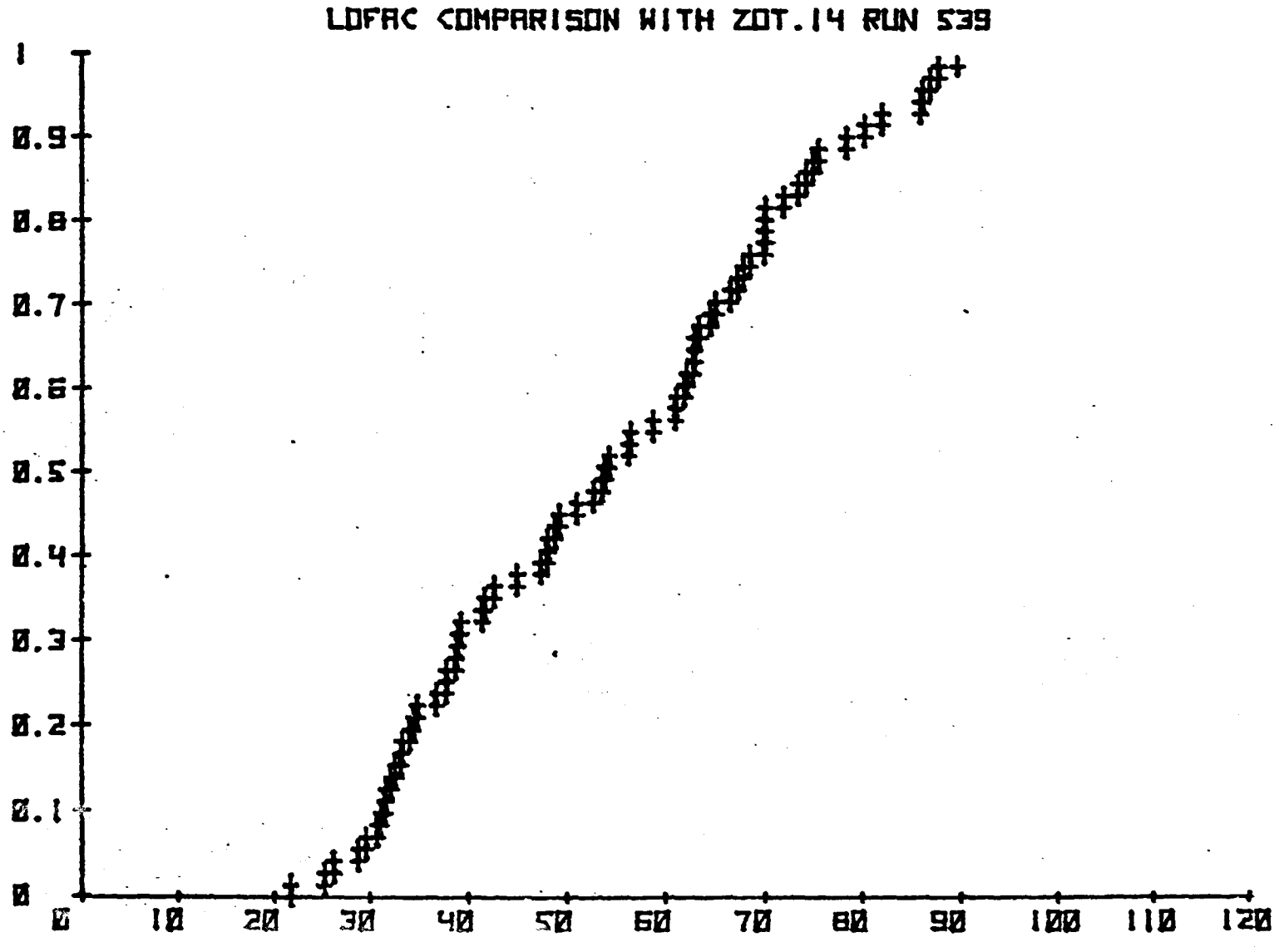
OBLIQUITY MEAN 54.1761 DEG, STANDARD DEVIATION 18.4169 DEG

PERCENTILES:

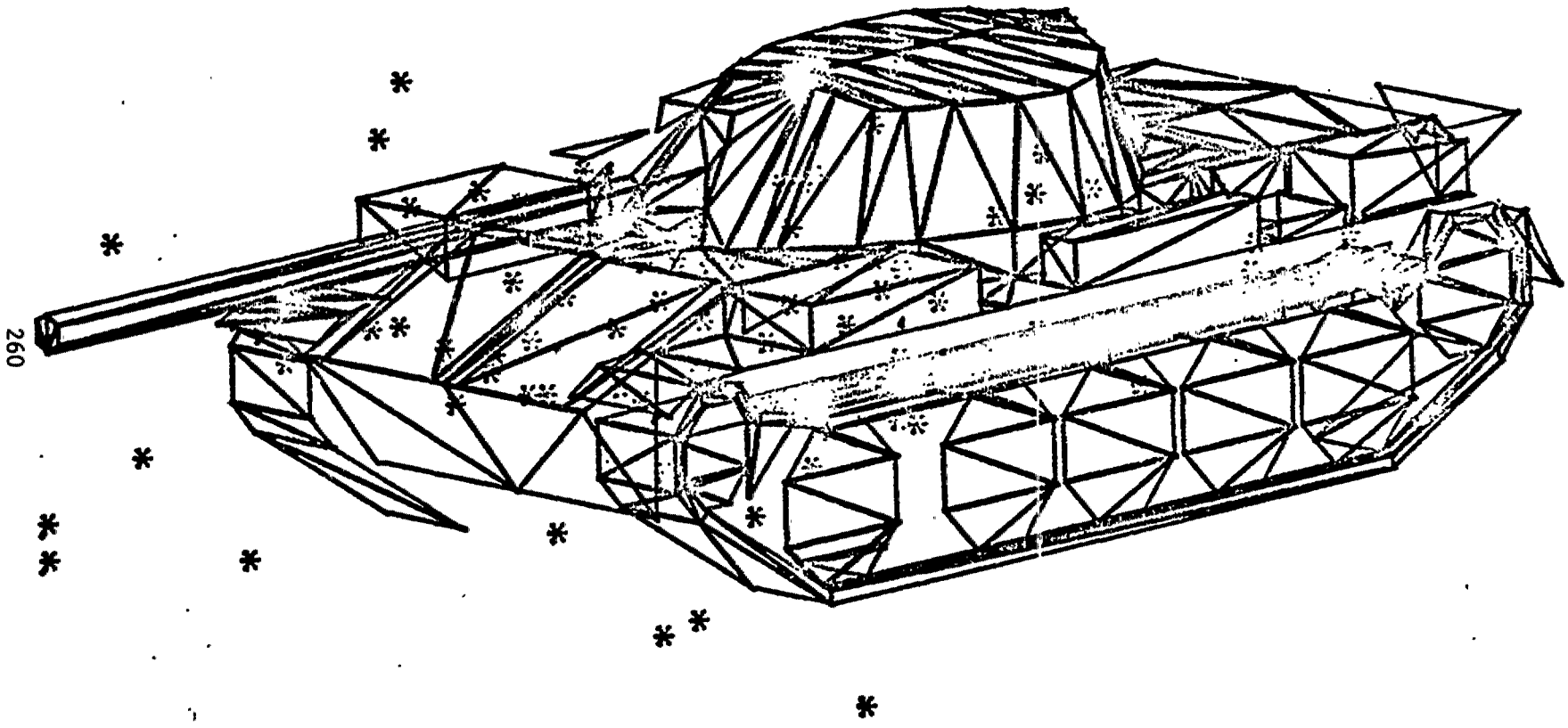
RANK	DEVIATE
0.05	27.82
0.10	31.26
0.15	32.59
0.20	34.28
0.25	37.83
0.30	39.01
0.35	41.98
0.40	48.00
0.45	50.12
0.50	54.03
0.55	58.06
0.60	62.22
0.65	63.22
0.70	65.93
0.75	68.77
0.80	70.32
0.85	74.65
0.90	80.17
0.95	86.71

LOFAC COMPARISON WITH ZOT.14 RUN 539

FACET NO.	NO. OF IMPACTS
136	8
-136	4
231	4
179	3
241	3
-231	2
-142	2
132	2
177	2
178	2
182	2
193	2
203	2
248	2
287	2
296	2
-274	1
-137	1
-134	1
-66	1
-65	1
11	1
13	1
18	1
28	1
47	1
64	1
66	1
118	1
144	1
171	1
184	1
235	1
239	1
243	1
246	1
250	1
251	1
275	1
277	1
283	1
284	1
286	1


LOFRC COMPARISON WITH ZOT.14 RUN 539
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 78.0 PHI = 46.6
SCALE: X = -265 TO 35
Y = -90 TO 110



260

LOFRC COMPARISON WITH ZOT.14 RUN 539

RODMAN LAB-PHYSICS

LOFAC COMPARISON WITH ZOT.14 RUN 540 PAGE 1

THERE WERE 17 MISSES

THEY WERE REPS #: 1 3 13 16 24 26 30 37 40 45 48 50 51
52 57 64 73

OBLIQUITY ANGLES IN ASCENDING ORDER (DEG):

75	12.9655	41	43.7766	34	54.7103	33	69.1071
35	15.4470	38	44.2628	56	55.7439	12	69.3848
69	22.6149	70	45.9613	77	55.8070	85	69.5395
61	24.7512	19	46.7131	67	56.3625	23	69.7547
72	24.8441	10	47.1471	80	56.4822	53	70.0226
42	26.7389	8	47.3320	79	57.5195	28	71.1778
78	26.9810	76	47.9065	2	58.6898	44	71.5600
74	28.7992	68	48.0329	82	59.6102	15	75.3337
71	30.5430	39	49.6462	62	60.2299	31	77.2243
36	33.7869	65	50.2395	54	65.1395	11	77.5674
21	34.0419	17	50.9534	46	65.7086	18	79.3434
66	34.1604	43	51.8436	84	66.7532	63	81.6638
22	34.2233	58	51.9795	60	66.7559	81	83.4130
25	35.8352	55	52.2234	27	67.9432	49	83.5677
14	36.3447	4	52.6441	6	68.1282	59	83.5918
7	39.6050	47	52.9251	9	68.1345	5	90.0512
29	42.7173	83	53.2318	32	68.2863	20	91.8563

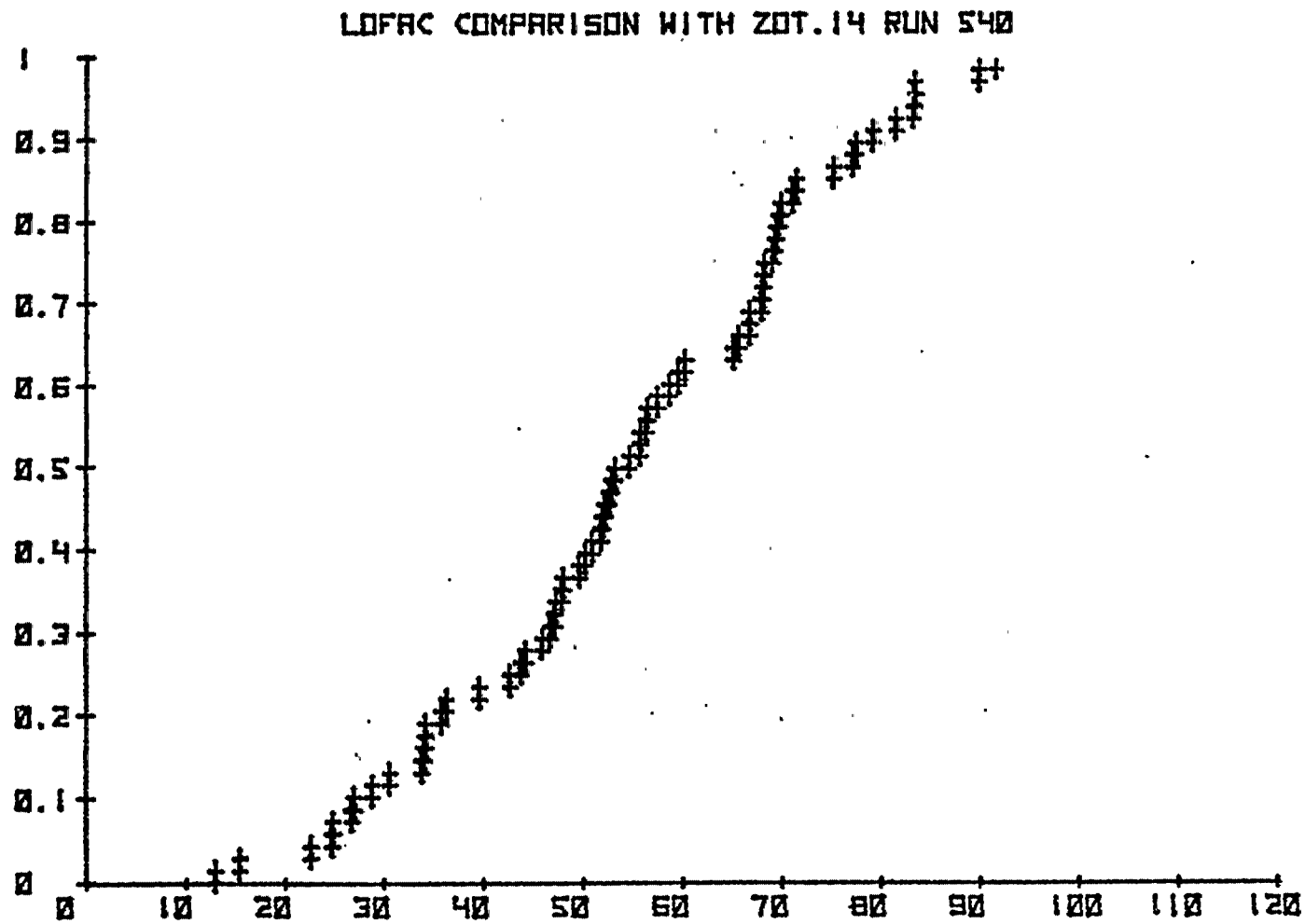
OBLIQUITY MEAN 54.5203 DEG, STANDARD DEVIATION 18.6225 DEG

PERCENTILES:

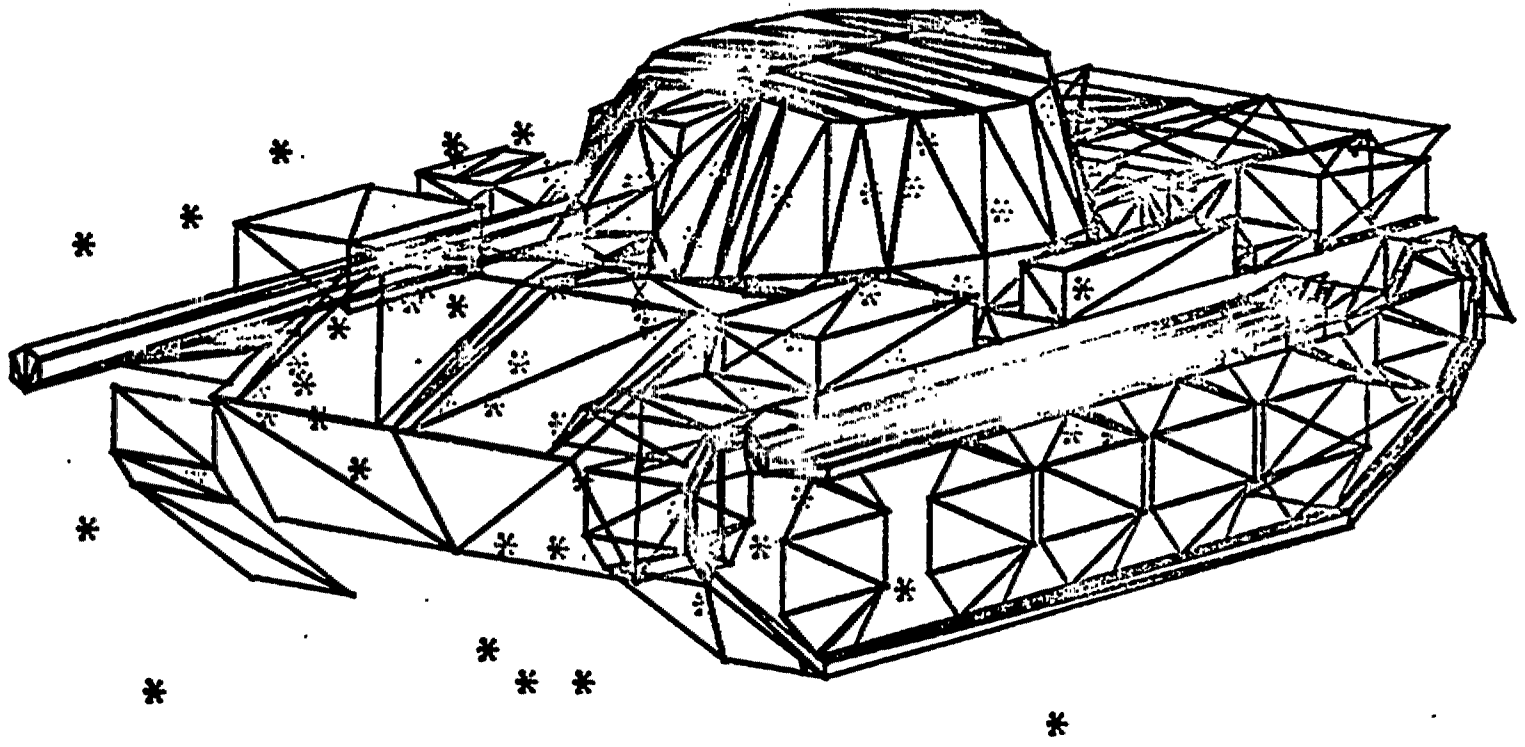
RANK	DEVIATE
0.05	23.58
0.10	26.96
0.15	33.88
0.20	35.51
0.25	42.98
0.30	46.49
0.35	47.93
0.40	50.67
0.45	52.24
0.50	53.97
0.55	56.33
0.60	59.06
0.65	65.62
0.70	68.00
0.75	68.90
0.80	69.81
0.85	74.01
0.90	79.58
0.95	83.58

LOFNC COMPARISON WITH ZOT.14 RUN 540

FACET NO.	NO. OF IMPACTS
-136	6
136	6
-134	3
134	3
118	2
171	2
178	2
196	2
234	2
246	2
251	2
270	2
283	2
287	2
-271	1
-137	1
-135	1
-67	1
8	1
22	1
28	1
29	1
45	1
66	1
68	1
132	1
135	1
146	1
179	1
182	1
'84	1
187	1
202	1
219	1
232	1
235	1
241	1
244	1
248	1
252	1
253	1
281	1
284	1
296	1


LOFAC COMPARISON WITH ZOT.14 RUN 540
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
110
120

RODMAN LAB-PHYSICS
THETA = 78.2 PHI = 37.0
SCALE: X = -250 TO 50
Y = -90 TO 110



LOFAC COMPARISON WITH ZOT.14 RUN 540

APPENDIX B

PROGRAM FOR PROCESSING FLIGHT SIMULATION TARGET DATA--IMPAC

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Description of IMPAC Program for Estimating Hit Probability and Distribution of Impact Obliquity

General Description

The IMPAC program is a postprocessor program which takes as input the results of a guidance simulation program (ZOT.14) and a geometric description of the surface of a target vehicle. It scores the outcome of each guided flight as a hit or miss and optionally computes the impact obliquity of each miss. Statistical measures of the distributions of guidance error (i.e., the vector from the intended impact point to the nearest point of the shot line), terminal projectile velocity and attitude, impact obliquity, and an estimate of the probability of hitting the target are computed.

Target Description

The target is modeled by means of a set of convex quadrilateral plane figures called facets. The coordinates of each corner of a single facet are punched on one card. The order of the corners determines the sense of the "outside" of the surface according to the right-hand rule: if the curled fingers of the right hand point in the sense of travel in a circuit from the first corner to the second, then to the third, to the fourth, and finally back to the first, then the thumb, cocked away from the hand, points outward from the surface.

Hit/Miss Scoring

The first step in scoring is to orient the target properly with respect to the projectile. Required data are the azimuthal heading of the target, the azimuth and elevation of the projectile velocity, the guidance error vector, and the position on the target of the intended impact point. A series of translational and rotational transformations of coordinates brings the target into a frame of reference whose mutually perpendicular axes are: (1) yaw-wise, parallel to the ground and normal to the projectile velocity; (2) pitch-wise, normal to the velocity and to the yaw direction; and (3) depth-wise, antiparallel to the velocity. The origin is the intended impact point.

Collapsing the depth coordinate brings the target into the "impact plane," having yaw and pitch coordinates only. The guidance error vector defines a point in this plane. Whether this point is on or off the target is determined by a "dot-product" method of hit/miss scoring, which proceeds as follows:

First, a facet is selected. The point A, known to be inside the boundaries of the facet's projection in the impact plane, is defined by averaging the positions of the first and third corners (see Fig B-1, below). Now, taking in turn the sides of the facet defined by corner pairs (1,2), (2,3), (3,4), and (4,1), the perpendicular vector R from point A to the side

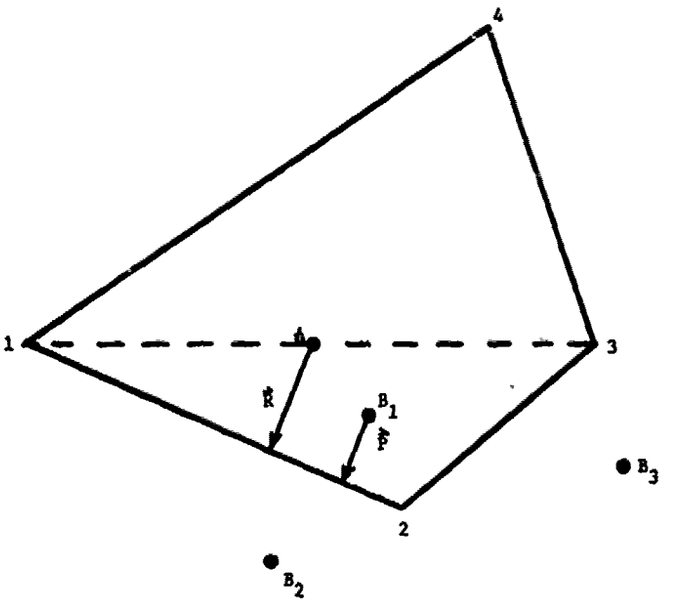

Figure B-1. Scoring Hits by the Dot-Product Method

is defined. Also, the perpendicular vector $\vec{P}$ from the impact point (guidance error vector) B to the side is defined. Figure 1 shows three possible locations, B_1, B_2, and B_3, for the impact point relative to the facet. If the dot product $\vec{R} \cdot \vec{P}$ is positive, A and B are on the same side of the side of the facet; if the dot product is negative, they are on opposite sides. Thus, a negative result for any of the four sides indicates a miss for the facet. A hit requires four positive results (a zero is considered the same as a positive, indicating a hit directly on the edge). In Figure 1, B_1 will thus score a hit, B_2 will score as a miss on the first side, and B_3 will score as a miss on the second side.

All facets may be scored in this manner. A hit on any facet is a hit on the target. All facets must be missed in order to score a miss on the target.

Impact Obliquity Scoring

If the purpose of the scoring is simply to score hits and misses, it is unnecessary to continue scoring facets once a single facet is found to be hit. For impact obliquity scoring, however, it is necessary to continue until all facets have been scored. The list of all facets scored as hits is then searched and the depthwise coordinate of the facet surface at the yaw and pitch coordinates of the impact is calculated for each facet. The maximum depth value (nearest the projectile as it encounters the target) identifies the facet actually struck.

The impact obliquity is calculated in a two-step procedure: (1) the normal direction to the facet that was struck is defined by calculating the cross (vector) product of the vectors of displacement from facet corners 1 to 2 and from 2 to 3 and then normalizing the product vector to unity modulus, and (2) the attitude of the projectile, defined by the angles of attack*, defines another unit vector, which is multiplied (scalar or dot product) by the facet-normal vector to give the cosine of the obliquity.

Input

Input to the program consists of the geometric description of the target, program control parameters, the target heading and location of the intended impact point on the target, and finally a set of card pairs, each pair describing the outcome of a single replication of the guidance simulation. The outcome for guided impacts is described by the miss vector, velocity vector, and angles of attack. In the case of a replication in which acquisition failed to occur, a "miss distance" of -1.0, followed by zeros for the remaining outcome data, flags the program to ignore the replication (except for tallying type of outcome).

Output

Most of the output from the program is printed. The description of the target and the control parameters are echoed and the outcome of each individual replication in sequence is given. A printer-plot showing, by means of printed characters, the (approximate) positions of facet corners and impacts as seen from the average direction of approach are displayed. This enables the user, with some practice, to draw a view of the target and impact distribution. Other plots available are a scatter plot of terminal angles of attack (pitch and yaw) and a cumulative plot of the obliquity distribution.

A summary of statistical measures follows, including means and standard deviations of miss distance, yaw miss error, pitch miss error, angles of attack, angles of approach, airspeed, and impact obliquity. Correlations between several of these statistics are calculated and displayed. Finally, ordered lists of the miss distances, yaw errors, pitch errors, and obliquities are displayed.

Supplementary output is a pair of punched cards containing the estimates of the values of obliquity corresponding to every fifth percentile from the 5th to the 95th.

User Options

The user may process up to one hundred replications per set. A unique combination of target heading and designation point is required for each set.

---

*Note that in this yaw-pitch-depth coordinates system, the velocity vector is antiparallel to the depth axis.

Sets of equal numbers of replications may be processed in groups of up to six sets. No commonality of parameters is required among sets; however, when values of one single parameter distinguish the sets of a group, an option is supplied to fit a curve of one of the guidance accuracy statistics to the varying parameter. The statistic fitted is the "equivalent circular-normal standard deviation," which is the standard deviation of a bivariate circular normal distribution having a probability of hitting a standard square target equal to that of the observed distribution of impacts.

Groups may be processed without limit, the only required point of commonality being the particular target vehicle model used.

The type of processing is controlled by a single control parameter IALPHA, having integer values 4 to 0. The interpretation of each value is as follows:

(4) Complete analysis including all plots. Target vehicle is transformed into individual impact plane for every replication.

(3) Same as (4) except that target vehicle is transformed only once into "mean impact plane" for hit/miss scoring, in order to save computational time. This option works well if the range of directions of approach is small. Adjustments to projectile attitude compensate for this approximation during obliquity scoring.

(2) Same as (3) except omit obliquity analysis.

(1) Same as (2) except omit angle-of-attack plot.

(0) Omit angle-of-attack data and score for hit/miss only (using mean-impact-plane method).

An example of input and output and a listing of the IMPAC program follow.

Example of Use of IMPAC

The following example illustrates the use of the IMPAC program. Three separate guidance simulation (ZOT.14) runs of 85 replications each are processed

The attached listing of the input deck is marked with reference symbols for the reader's convenience.

The first card (ref. A), format (I3), indicates that the target model consists of 66 facets. The remaining characters on the card are not read by the program but serve to identify the target specification deck to the user.

The following 66 cards (ref. B), format (12F6.2), contain the coordinates of the facet corners--one facet per card.

A title card (ref. C), contains whatever label information the user desires in order to identify the following group of card sets. The next card, format (4I3, 8X, F10.0, 10X, 10A4) contains the information that 3 sets of 85 replications are to be processed with control parameter IALPHA = 3 and no curve-fit of equivalent standard deviation (NGO = 0). (NGO = 1 if the curve-fit is desired). Also on this card is the information that the standard square target used in calculating equivalent standard deviation is 7.5 feet and that the parameter distinguishing the 3 sets is the designation range in kilometers. The following card, format (8F10.0), contains the values of the distinguishing parameter for each set (1.0, 2.0, and 4.0 kilometers, respectively).

Following the above control data are the card sets describing outcomes of guidance simulations (refs. D, E, F). Each set begins with a single card, format (40X, 4F10.0), indicating the heading of the target vehicle and the designation point on the vehicle. Following are pairs of cards indicating the terminal status of the projectile for each replication. The alphanumeric identifiers at the beginning of each of these cards are not read by the program but are for the user's conveniences. Only the floating-point data are read.

After the last card set of the group (ref. G), the user may begin a new group, starting with the control data of reference C. After the last group, a blank card is inserted as shown at reference G before the end-of-file card.

The attached output shows the results of processing the given input data deck. Table B-1 explains those terms used which are not self-explanatory. Note that the impact-plane scatter plot has been completed for the first set, but not for the others.

TABLE B-1. EXPLANATION OF TERMS IN IMPAC OUTPUT

FACET CORNER COORDINATES: Each line of output represents one facet. The four groups of three numbers represent the four corners in sequence. The first coordinate of each triplet is the distance from the trailing edge of the vehicle forward to the corner times -1.0. The second coordinate is the height of the corner above ground level. The third coordinate is the distance from the centerline of the vehicle to the corner, measured to the driver's left. All the above distances are in inches.

REP: Replication number.

YAW: Lateral or sideways distance of shot line from aim point, in feet.

PITCH: "Vertical" distance of shot line from aim point, in feet. Both yaw and pitch are measured perpendicular to the velocity.

ALPHA: Angle of attack in degrees. Subscript Y or P for yaw or pitch. Positive yaw is nose left and positive pitch is nose up.

PHI.V: Azimuth of terminal velocity vector in degrees in ZOT coordinate system.

THETA.V: Elevation of terminal velocity vector in degrees.

BETA: Projectile orientation angles with respect to the normal to the impact plane used for scoring. For IALPHA = 4, BETA = ALPHA. For IALPHA < 4, BETA = ALPHA + a correction for the deviation of the velocity angles from the mean velocity angles.

IMPACT PLANE PLOT: The letter O marks the position of one or more facet corners. The asterisk (*) marks the position of one impact. A digit from 2 to 9 marks a printer cell in which multiple impacts, as indicated, occurred. The letter X indicates 10 or more impacts in a cell. The plot is drawn from the aspect of the mean direction of approach. Distances are in feet.

ANGLES-OF-ATTACK PLOT: The same characters as above, except the letter O, are used to indicate terminal attitudes of the projectile for each replication. Note that since positive yaw is nose left, the plot is mirror-imaged. Units are degrees.

OBLIQUITY CUMULATIVE PLOT: The plus sign (+) indicates the points of the sample distribution.

OUTCOMES: Outcomes are separated into the three categories listed. The fraction that acquired the target is the approximate probability of target being in acquisition footprint, which applies only to the specific conditions of the simulation and is not to be taken as representative.

TABLE B-1. EXPLANATION OF TERMS IN IMPAC OUTPUT (CONT)

CORRELATIONS: YAW-PITCH is correlation between yaw and pitch coordinates of impact points. ALPHA.Y-ALPHA.P is correlation between yaw and pitch angles of attack. ALPHA.Y-ERR.Y is correlation between yaw angle of attack and yaw coordinate of impact point and, similarly, for pitch.

HIT PROBABILITIES: Approximate square target hit probability is fraction of impacts falling within the square of specified size centered on the designation point and oriented in the impact plane. Derived square target hit probability is that probability predicted using the means and standard deviations of yaw and pitch impact points in an uncorrelated bivariate normal distribution to estimate the probability covered by the square target. Vehicular target hit probability is the fraction of the sample hitting the target.

EQUIVALENT CIRCULAR-NORMAL STD DEV: The standard deviation of a zero-mean circular normal distribution for which the square-target hit probability equals the derived value discussed above.

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Listing of Example Input

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(A)
(B)

-13200	8195	0	-13200	7600	-3800	-17398	7716	-1339	-17800	7900	0
-13200	8195	0	-10000	8400	0	-10735	7909	-2835	-13200	7600	-3800
-13200	8195	0	-13200	7600	3800	-10735	7909	2835	-10000	8400	0
-13200	8195	0	-17800	7900	0	-17398	7716	1339	-13200	7600	3800
-19100	5700	0	-17800	7900	0	-17398	7716	-1339	-18300	5700	-2100
-18300	5700	-2100	-17398	7716	-1339	-13200	7600	-3800	-13200	5700	-5000
-13200	5700	-5000	-13200	7600	-3800	-10735	7909	-2835	-10000	5700	-4000
-10000	5700	-4000	-10735	7909	-2835	-10000	8400	0	-8600	5700	0
-8600	5700	0	-10000	8400	0	-10735	7909	2835	-10000	5700	4000
-10000	5700	4000	-10735	7909	2835	-13200	7600	3800	-13200	5700	5000
-13200	5700	5000	-13200	7600	3800	-17398	7716	1339	-18300	5700	2100
-18300	5700	2100	-17398	7716	1339	-17800	7900	0	-19100	5700	0
-19800	5700	1000	-19800	6800	1000	-19800	6800	-1000	-19800	5700	-1000
-19800	6800	1000	-17800	8000	1000	-17800	8000	-1000	-19800	6800	-1000
-17800	8000	1000	-17400	8000	1000	-17400	8000	-1000	-17800	8000	-1000
-19800	5700	1000	-17800	5700	1000	-17800	8000	1000	-19800	6800	1000
-17800	5700	1000	-17400	5700	1000	-17400	8000	1000	-17800	8000	1000
-19800	5700	-1000	-19800	6800	-1000	-17800	8000	-1000	-17800	5700	-1000
-17800	5700	-1000	-17800	8000	-1000	-17400	8000	-1000	-17400	5700	-1000
-17400	8000	1000	-17400	5700	1000	-17400	5700	-1000	-17400	8000	-1000
-21200	0	6400	-24400	4800	6400	-25500	4300	6400	-25100	2300	6400
-21200	0	6400	-5800	0	6400	-2400	4800	6400	-24400	4800	6400
-5800	0	6400	-2800	1600	6400	-900	3500	6400	-2400	4800	6400
-2400	4800	6400	-2400	5700	6400	-21600	5700	6400	-21600	4800	6400
-21200	0	4000	-25100	2300	4000	-25500	4300	4000	-24400	4800	4000
-21200	0	4000	-24400	4800	4000	-2400	4800	4000	-5800	0	4000
-5800	0	4000	-2400	4800	4000	-900	3500	4000	-2800	1600	4000
-2400	4800	4000	-21600	4800	4000	-21600	5700	4000	-2400	5700	4000
-21200	0	6400	-25100	2300	6400	-25100	2300	4000	-21200	0	4000
-25100	2300	6400	-25500	4300	6400	-25500	4300	4000	-25100	2300	4000
-25500	4300	6400	-24400	4800	6400	-24400	4800	4000	-25500	4300	4000
-24400	4800	6400	-21600	4800	6400	-21600	4800	4000	-24400	4800	4000
-21600	4800	6400	-21600	5700	6400	-21600	5700	4000	-21600	4800	4000
-21600	5700	6400	-2400	5700	6400	-2400	5700	4000	-21600	5700	4000
-2400	5700	6400	-2400	4800	6400	-2400	4800	4000	-2400	5700	4000
-2400	4800	6400	-900	3500	6400	-900	3500	4000	-2400	4800	4000
-900	3500	6400	-2800	1600	6400	-2800	1600	4000	-900	3500	4000
-2800	1600	6400	-5800	0	6400	-5800	0	4000	-2800	1600	4000
-21200	0	-4000	-24400	4800	-4000	-25500	4300	-4000	-25100	2300	-4000
-21200	0	-4000	-5800	0	-4000	-2400	4800	-4000	-24400	4800	-4000
-5800	0	-4000	-2800	1600	-4000	-900	3500	-4000	-2400	4800	-4000
-2400	4800	-4000	-2400	5700	-4000	-21600	5700	-4000	-21600	4800	-4000
-21200	0	-6400	-25100	2300	-6400	-25500	4300	-6400	-24400	4800	-6400
-21200	0	-6400	-24400	4800	-6400	-2400	4800	-6400	-5800	0	-6400
-5800	0	-6400	-2400	4800	-6400	-900	3500	-6400	-2800	1600	-6400
-2400	4800	-6400	-21600	4800	-6400	-21600	5700	-6400	-2400	5700	-6400
-21200	0	-4000	-25100	2300	-4000	-25100	2300	-6400	-21200	0	-6400
-25100	2300	-4000	-25500	4300	-4000	-25500	4300	-6400	-25100	2300	-6400
-25500	4300	-4000	-24400	4800	-4000	-24400	4800	-6400	-25500	4300	-6400
-24400	4800	-4000	-21600	4800	-4000	-21600	4800	-6400	-24400	4800	-6400
-21600	4800	-4000	-21600	5700	-4000	-21600	5700	-6400	-21600	4800	-6400
-21600	5700	-4000	-2400	5700	-4000	-2400	5700	-6400	-21600	5700	-6400
-2400	5700	-4000	-2400	4800	-4000	-2400	4800	-6400	-2400	5700	-6400
-2400	4800	-4000	-900	3500	-4000	-900	3500	-6400	-2400	4800	-6400
-900	3500	-4000	-2800	1600	-4000	-2800	1600	-6400	-900	3500	-6400
-2800	1600	-4000	-5800	0	-4000	-5800	0	-6400	-2800	1600	-6400
-23600	1700	4000	-20000	5700	4000	-21200	5700	4000	-25440	4000	4000
-4600	1700	4000	-2800	2600	4000	-1900	5300	4000	-2400	5700	4000
-23600	1700	-4000	-25440	4000	-4000	-21200	5700	-4000	-20000	5700	-4000

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 -4600  1700 -4000 -2400  5700 -4000 -1900  5300 -4000 -2800  2600 -4000
-23600  1700  4000-25440  4000  4000-25440  4000 -4000-23600  1700 -4000
-25440  4000  4000-21200  5700  4000-21200  5700 -4000-25440  4000 -4000
-21200  5700  4000 -2400  5700  4000 -2400  5700 -4000-21200  5700 -4000
 -2400  5700  4000 -1900  5300  4000 -1900  5300 -4000 -2400  5700 -4000
 -1900  5300  4000 -2800  1600  4000 -2800  1600 -4000 -1900  5300 -4000
 -2800  1600  4000 -5800     0  4000 -5800     0 -4000 -2800  1600 -4000
SUPPLEMENTARY NAVY RUNS -- T2 AT 12 KM GTR, DP = 1, 2, 4 KM, -- 30 AUG 1976
  3 85  3  0        7.5                    KM  DESIGNATION RANGE
1.        2.        4.
ZOT.14 RUN1193                                -115.0000  -209.4   57.6      18.
ZOT.14 RUN1193, REP  1                           1.385624    -1.385600     -0.008270
1193   1       -11.044741  4.864211          790.913175    -4.432779    349.735768
ZOT.14 RUN1193, REP  2                           2.711310    -2.710325      0.073087
1193   2        -9.970550 -6.624056          786.807836   -16.882275    359.984812
ZOT.14 RUN1193, REP  3                           3.092089     3.071169     -0.359088
1193   3        10.185338  6.978349          789.830562     5.164008    344.874565
ZOT.14 RUN1193, REP  4                           1.261119     0.611758      1.102803
1193   4        10.509289  6.110326          792.517042   -16.970638    338.346766
ZOT.14 RUN1193, REP  5                           2.908360    -2.906529     -0.103251
1193   5       -12.069125  6.243145          789.123901    -4.364604    340.675033
ZOT.14 RUN1193, REP  6                           0.138744    -0.132882      0.039905
1193   6        -8.080421  6.271992          790.842982     7.326787    340.000730
ZOT.14 RUN1193, REP  7                           1.326075    -1.298221     -0.270376
1193   7       -10.234457  5.730482          791.127022     0.271053    347.388523
ZOT.14 RUN1193, REP  8                           1.831586    -0.794827     -1.650141
1193   8         2.295356  9.028378          791.388658   -19.760858    350.581787
ZOT.14 RUN1193, REP  9                           1.875721    -1.873265      0.095978
1193   9        -4.707730  4.551065          793.045123   -15.025260    349.270159
ZOT.14 RUN1193, REP 10                           2.370149     1.895631     -1.422743
1193  10         3.556624  8.578588          789.683217     2.789669    356.254539
ZOT.14 RUN1193, REP 11                           1.035085    -0.414476     -0.948479
1193  11         9.613463  9.291396          790.354583   -25.8644 4    346.328467
ZOT.14 RUN1193, REP 12                           1.201420    -1.141888     -0.373504
1193  12        -9.198356 -1.251271          787.461327     4.025964    356.542536
ZOT.14 RUN1193, REP 13                           0.885790     0.726092     -0.507375
1193  13        -8.563947  7.857152          790.942852     8.232649    343.364523
ZOT.14 RUN1193, REP 14                           3.142821    -2.516915     -1.882146
1193  14         8.377177  4.615126          785.787006   -30.614894    360.205710
ZOT.14 RUN1193, REP 15                           1.628312    -1.276662     -1.010710
1193  15        -9.688398  8.238100          790.795049    -4.729928    348.803849
ZOT.14 RUN1193, REP 16                           1.202986     0.730077      0.956120
1193  16         8.602833  4.871736          793.706911   -14.383094    339.804780
ZOT.14 RUN1193, REP 17                           0.730994     0.365184     -0.633240
1193  17         9.314683  2.553922          787.832302   -26.029319    352.597990
ZOT.14 RUN1193, REP 18                           1.533329     0.095018      1.245008
1193  18         4.953931 -8.209817          789.720674    -4.425714    354.770713
ZOT.14 RUN1193, REP 19                           2.113396    -1.980834     -0.736714
1193  19        -9.142906  8.539272          792.119178   -11.018472    346.784762
ZOT.14 RUN1193, REP 20                           2.163033    -1.979737     -0.871409
1193  20       -10.755454  7.311935          789.626612    -1.601578    349.247729
ZOT.14 RUN1193, REP 21                           1.334248    -1.139349      0.694338
1193  21        -7.021179  3.124843          793.656508   -11.416697    342.140694
ZOT.14 RUN1193, REP 22                           0.415790    -0.411447      0.059939
1193  22        -7.952667  2.571854          792.874844    -4.409800    345.845421
ZOT.14 RUN1193, REP 23                           1.017559     0.587413      0.830887
1193  23        10.567446  2.636086          791.483819   -18.091530    339.820535
ZOT.14 RUN1193, REP 24                           1.841177    -0.059693     -1.840209
1193  24        -0.827397  6.921413          791.014705    -4.298816    356.585536
ZOT.14 RUN1193, REP 25                           1.128413     1.027046     -0.467433
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1193 25	-6.823958	5.989856	788.822231	9.945510	351.039726
ZOT,14 RUN1193, REP 26			4.694262	-4.421522	-1.576787
1193 26	-11.535285	1.220402	785.794377	-19.706181	363.445231
ZOT,14 RUN1193, REP 27			1.382450	-1.379849	-0.084770
1193 27	-2.771472	2.835180	793.285998	-15.299916	348.630148
ZOT,14 RUN1193, REP 28			1.908036	-1.904422	-0.117379
1193 28	-11.909305	0.005345	789.073149	-1.612483	354.641977
ZOT,14 RUN1193, REP 29			0.546574	0.494978	0.231819
1193 29	7.434720	6.501615	793.627793	-9.873153	340.321703
ZOT,14 RUN1193, REP 30			0.292808	0.259501	-0.135631
1193 30	5.538324	5.309656	793.203566	-13.327345	347.977862
ZOT,14 RUN1193, REP 31			1.615327	-1.615147	-0.024143
1193 31	-9.317101	7.721274	790.609501	1.068162	340.949104
ZOT,14 RUN1193, REP 32			1.910545	-1.880612	-0.336875
1193 32	-7.212926	8.241246	792.120834	-17.822245	344.114013
ZOT,14 RUN1193, REP 33			0.421135	-0.254295	0.335692
1193 33	8.157345	-1.755747	790.607701	-18.114682	353.781257
ZOT,14 [illegible] REP 34			2.354357	-2.333300	0.314190
1193 34	6.458731	2.913696	789.670530	-33.288151	345.634271
ZOT,14 RUN 93, REP 35			1.734487	1.703489	-0.326449
1193 35	11.269327	1.467383	787.609594	-19.236178	356.608204
ZOT,14 RUN1193, REP 36			0.187123	-0.089279	-0.164451
1193 36	-4.187868	6.339626	792.824227	-2.679066	349.199946
ZOT,14 RUN1193, REP 37			0.970356	0.016637	-0.970214
1193 37	-4.044580	9.265235	787.910020	9.043702	346.553871
ZOT,14 RUN1193, REP 38			0.621671	0.418651	-0.459572
1193 38	-4.461109	7.761684	788.686199	9.752102	342.934386
ZOT,14 RUN1193, REP 39			0.877046	-0.925456	-0.296364
1193 39	-4.870232	2.397570	792.470434	-10.650544	352.632234
ZOT,14 RUN1193, REP 40			0.570034	0.083300	-0.563915
1193 40	-6.771933	3.915153	788.544996	8.381439	351.417789
ZOT,14 RUN1193, REP 41			1.575726	-0.662311	-1.539287
1193 41	-9.851511	7.262705	789.818612	-1.652188	355.049492
ZOT,14 RUN1193, REP 42			3.839921	-3.695442	-1.043416
1193 42	-7.032189	-0.953122	787.666388	-21.681921	359.987724
ZOT,14 RUN1193, REP 43			1.562857	0.599861	-1.443153
1193 43	-7.480295	8.674706	789.238231	7.717624	353.933985
ZOT,14 RUN1193, REP 44			1.287190	-0.921184	-0.899042
1193 44	4.244453	6.479818	789.123043	-27.082903	355.590132
ZOT,14 RUN1193, REP 45			2.113359	-2.113216	0.024612
1193 45	-7.098605	4.877791	792.308362	-9.427971	349.109736
ZOT,14 RUN1193, REP 46			0.530831	-0.358655	0.391342
1193 46	-8.068671	4.440124	792.629501	1.847079	343.798744
ZOT,14 RUN1193, REP 47			0.309664	0.134396	-0.278979
1193 47	-3.094373	9.462181	792.342247	-3.073550	349.314075
ZOT,14 RUN1193, REP 48			1.386285	1.293191	0.499446
1193 48	9.719320	-10.312929	786.364849	-7.537334	358.248720
ZOT,14 RUN1193, REP 49			2.362867	0.970967	-2.154152
1193 49	5.798015	8.811057	788.297449	-13.824053	360.514889
ZOT,14 RUN1193, REP 50			0.261923	-0.173024	-0.861611
1193 50	-12.721609	7.030150	788.909249	-18.408173	350.278810
ZOT,14 RUN1193, REP 51			1.354215	-1.233274	-0.559407
1193 51	3.028244	3.340688	791.793450	-21.503735	351.099220
ZOT,14 RUN1193, REP 52			0.997385	0.992314	-0.100445
1193 52	7.307839	6.259540	790.824094	-4.047178	349.667393
ZOT,14 RUN1193, REP 53			0.405146	-0.334470	0.228634
1193 53	4.120126	4.151814	793.290457	-19.124042	342.515858
ZOT,14 RUN1193, REP 54			0.289885	-0.182018	0.225616
1193 54	9.210676	0.095267	789.668259	-23.606418	352.295046
ZOT,14 RUN1193, REP 55			2.397861	2.292285	0.703684

1193 55	9.909929	-5.423050	788.628508	-4.788757	356.268945
ZOT.14 RUN1193, REP 56			1.292836	-1.292788	-0.011214
1193 56	2.774244	5.067660	792.825049	-18.779217	348.910649
ZOT.14 RUN1193, REP 57			1.456584	-0.262933	-1.432657
1193 57	4.9968..	8.704489	792.717229	-13.746773	349.630808
ZOT.14 RUN1193, REP 58			1.853326	-1.820284	0.348403
1193 58	-9.992911	-3.006383	790.910398	-6.025172	349.842628
ZOT.14 RUN1193, REP 59			1.389390	1.182961	-0.728703
1193 59	1.996215	7.912231	792.837214	-0.399732	344.653243
ZOT.14 RUN1193, REP 60			2.348482	-1.335515	-1.931779
1193 60	-2.104286	7.357155	790.854336	-18.017434	356.340582
ZOT.14 RUN1193, REP 61			0.192254	0.131935	-0.139838
1193 61	1.461962	7.403467	793.927316	-10.386657	341.764856
ZOT.14 RUN1193, REP 62			0.747007	-0.666139	-0.338050
1193 62	2.181004	3.591460	793.291691	-15.839573	350.028986
ZOT.14 RUN1193, REP 63			2.758474	-2.713361	-0.496848
1193 63	-4.626889	7.606827	792.514970	-20.832657	347.545472
ZOT.14 RUN1193, REP 64			2.650416	-2.048102	-1.682256
1193 64	-10.778860	9.908530	787.884425	0.503008	347.106578
ZOT.14 RUN1193, REP 65			1.205278	0.940693	-0.753521
1193 65	6.158352	5.254177	791.607745	-12.041414	352.282668
ZOT.14 RUN1193, REP 66			0.980766	0.940423	-0.278400
1193 66	0.320991	2.170412	792.600839	0.359136	350.786322
ZOT.14 RUN1193, REP 67			0.649843	-0.648116	0.047355
1193 67	-5.689936	8.441792	789.868677	7.897653	341.655733
ZOT.14 RUN1193, REP 68			1.435674	1.414560	0.245322
1193 68	0.488896	6.997652	794.092804	-5.581596	341.525084
ZOT.14 RUN1193, REP 69			3.399922	3.239771	1.031199
1193 69	11.423216	3.930901	792.027865	-4.834087	339.984907
ZOT.14 RUN1193, REP 70			1.618043	-1.363331	-0.872917
1193 70	-12.355347	7.058852	789.476306	-4.007969	354.265958
ZOT.14 RUN1193, REP 71			0.726608	-0.720527	-0.093811
1193 71	-2.280613	7.025103	793.401546	-8.422509	342.283233
ZOT.14 RUN1193, REP 72			2.719223	-1.190455	-2.444789
1193 72	7.965035	6.942536	786.133549	-29.247836	359.578768
ZOT.14 RUN1193, REP 73			1.643459	1.581876	-0.445677
1193 73	-4.244218	6.473998	792.699952	2.725314	343.371790
ZOT.14 RUN1193, REP 74			2.657867	2.554678	-0.733406
1193 74	-2.603675	7.761769	790.838153	10.593912	349.376017
ZOT.14 RUN1193, REP 75			2.952060	2.926928	0.384396
1193 75	1.228509	1.064974	789.130577	11.968952	348.931070
ZOT.14 RUN1193, REP 76			1.532917	-1.305575	-0.803311
1193 76	4.377442	1.618057	791.026279	-19.957444	355.580874
ZOT.14 RUN1193, REP 77			1.113808	-1.004594	0.481000
1193 77	-2.632459	7.430662	794.182750	-11.832970	341.501792
ZOT.14 RUN1193, REP 78			0.323197	0.235838	0.220990
1193 78	10.584560	2.623664	791.460454	-18.030960	346.361633
ZOT.14 RUN1193, REP 79			1.157202	-1.084737	-0.403068
1193 79	1.147212	-9.901123	783.809179	-14.644455	367.697074
ZOT.14 RUN1193, REP 80			1.952402	1.774985	0.813206
1193 80	9.969762	1.450533	788.538884	-20.905306	350.142256
ZOT.14 RUN1193, REP 81			0.916925	-0.103531	-0.911062
1193 81	2.200171	-0.730974	790.094281	-10.916493	360.064113
ZOT.14 RUN1193, REP 82			1.096024	-0.858483	0.681379
1193 82	-8.969621	3.489070	791.337405	4.095616	340.922409
ZOT.14 RUN1193, REP 83			1.088917	0.272485	-1.054273
1193 83	4.306310	2.866287	790.556952	-7.152678	357.576533
ZOT.14 RUN1193, REP 84			0.804604	0.432867	0.678244
1193 84	-1.959713	-7.561201	788.073726	-3.233225	358.506276
ZOT.14 RUN1193, REP 85			1.978429	-1.974913	0.117919

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1193  85        -4.688376  4.732602    794.131889    -12.007488    341.209205
ZOT.14 RUN1194                          -115.0000  -209.4  57.6     18.
ZOT.14 RUN1194, REP  1                   2.428423     -2.360471      0.570453
1194   1        -12.697800  5.328043    787.213020     -4.445298    348.538996
ZOT.14 RUN1194, REP  2                   4.813090     -4.737759      0.848244
1194   2        -14.733392-11.720329    776.376530    -25.325465    364.581161
ZOT.14 RUN1194, REP  3                   0.257793     -0.183458     -0.181109
1194   3         11.171524  6.616267    784.988857    -12.210756    340.589080
ZOT.14 RUN1194, REP  4                   1.365117      1.362166     -0.089720
1194   4         12.271487  3.022425    787.952374    -18.300666    341.401027
ZOT.14 RUN1194, REP  5                   6.290107     -6.031416     -1.785356
1194   5        -12.147950  3.826393    781.583046     -9.338046    343.970229
ZOT.14 RUN1194, REP  6                   1.732936     -1.297026     -1.149258
1194   6         -1.911719  6.068110    787.600331      5.498156    340.960692
ZOT.14 RUN1194, REP  7                   2.954719     -2.944833     -0.241512
1194   7         -9.304896  7.123944    789.214561     -0.178784    344.459328
ZOT.14 RUN1194, REP  8                   2.971565     -0.920139     -2.825516
1194   8          4.117652 10.441437    786.057081    -28.423897    351.581079
ZOT.14 RUN1194, REP  9                   3.441868     -3.408039      0.481393
1194   9         -6.909325  4.555375    791.796848    -20.376210    347.862415
ZOT.14 RUN1194, REP 10                   4.672364      4.084619     -2.268674
1194  10          4.958884 10.955210    781.989452     14.586900    361.282687
ZOT.14 RUN1194, REP 11                   1.706742      0.748309     -1.533951
1194  11          5.635249  9.878288    788.027292    -27.583941    346.150797
ZOT.14 RUN1194, REP 12                   2.534369     -2.530109     -0.146888
1194  12         -8.784971 -6.951767    779.859667      6.042364    361.749328
ZOT.14 RUN1194, REP 13                   1.210394      0.727044     -0.967709
1194  13         -1.390714  4.743473    788.744388      8.716885    344.124740
ZOT.14 RUN1194, REP 14                   4.403756     -2.982998     -3.239566
1194  14          1.810855  3.592109    778.033788    -32.314407    370.275814
ZOT.14 RUN1194, REP 15                   2.629304     -2.114993     -1.562066
1194  15        -11.486135  8.670108    785.889186     -4.483284    348.533753
ZOT.14 RUN1194, REP 16                   2.503339      2.204875      1.185429
1194  16         11.110939  5.961871    791.849740    -15.124802    337.087856
ZOT.14 RUN1194, REP 17                   3.084081      2.995756     -0.732812
1194  17          6.114002  0.393891    783.699318    -22.583587    355.522746
ZOT.14 RUN1194, REP 18                   3.984246      2.429733      3.157629
1194  18          6.980733-13.608196    784.844799      1.986229    354.947982
ZOT.14 RUN1194, REP 19                   3.518904     -3.365273     -1.028409
1194  19        -13.369151  9.146554    788.502612    -13.696710    344.750989
ZOT.14 RUN1194, REP 20                   4.087996     -3.912795     -1.183961
1194  20         -9.725628  8.643257    785.258369     -3.486184    348.339006
ZOT.14 RUN1194, REP 21                   1.738386     -1.677542      0.455897
1194  21        -10.129777  5.204604    791.680555    -14.206954    341.451392
ZOT.14 RUN1194, REP 22                   0.371252     -0.279938      0.243850
1194  22        -10.227835  2.077966    790.678467     -1.194647    343.023921
ZOT.14 RUN1194, REP 23                   2.173362      2.150299      0.315784
1194  23         11.58'371  7.226027    787.099176    -18.033870    335.625152
ZOT.14 RUN1194, REP 24                   3.414493      0.254074     -3.405028
1194  24         -1.452055  7.749859    786.299611      1.635552    362.543295
ZOT.14 RUN1194, REP 25                   1.032341      0.974496     -0.340713
1194  25         -5.294610  6.910782    785.685237     11.986972    352.229510
ZOT.14 RUN1194, REP 26                   7.821687     -7.379829     -2.591713
1194  26        -15.027992 -2.631352    772.954827    -28.172855    374.560309
ZOT.14 RUN1194, REP 27                   2.441571     -2.438800      0.116297
1194  27         -4.354934  1.224710    792.045335    -20.638709    346.425511
ZOT.14 RUN1194, REP 28                   3.665112     -3.647605      0.357842
1194  28        -12.838202 -4.255749    783.659316     -1.819163    357.804996
ZOT.14 RUN1194, REP 29                   3.531538      1.709074     -3.090443
1194  29         10.769495  8.728121    789.000918     -7.348946    352.321993
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ZOT.14 RUN1194, REP 30			1.223620	1.185326	0.303724
1194 30	8.714451	5.886629	792.120385	-15.205709	345.259253
ZOT.14 RUN1194, REP 31			4.337910	-4.205068	-1.065311
1194 31	-7.824519	4.945197	786.232594	-0.718130	342.434561
ZOT.14 RUN1194, REP 32			2.836164	-2.796186	-0.474531
1194 32	-10.483053	6.991395	787.315412	-24.656918	342.107168
ZOT.14 RUN1194, REP 33			0.956309	-0.055064	0.954722
1194 33	10.193328	-7.386459	786.047712	-21.844217	355.940902
ZOT.14 RUN1194, REP 34			1.942648	-1.600626	1.106856
1194 34	0.474259	1.202635	787.620544	-33.049437	342.087030
ZOT.14 RUN1194, REP 35			4.726411	4.725785	-0.077128
1194 35	11.109805	-1.298172	780.504637	-17.125229	361.797253
ZOT.14 RUN1194, REP 36			0.513955	0.459666	0.229906
1194 36	-7.100080	7.444437	790.589921	4.549969	347.727458
ZOT.14 RUN1194, REP 37			3.651485	-2.991395	-2.094015
1194 37	-2.072706	9.015207	783.140029	2.816651	346.855816
ZOT.14 RUN1194, REP 38			2.862694	-2.444774	-1.489329
1194 38	-3.938226	5.778446	784.707789	4.164826	344.135788
ZOT.14 RUN1194, REP 39			1.364119	-1.326443	-0.318386
1194 39	-8.045808	0.192086	790.495819	-11.276252	354.428419
ZOT.14 RUN1194, REP 40			1.273845	-1.163807	-0.517916
1194 40	-4.369042	3.507072	785.335176	6.515173	352.600017
ZOT.14 RUN1194, REP 41			2.684317	-0.948914	-2.511000
1194 41	-9.954250	8.751497	785.154498	0.541409	359.688729
ZOT.14 RUN1194, REP 42			6.485277	-6.305279	-1.517331
1194 42	-9.880539	-6.640354	776.718730	-31.653250	367.291134
ZOT.14 RUN1194, REP 43			2.490797	0.922141	-2.313812
1194 43	-1.254716	10.975455	784.400175	12.487581	357.927777
ZOT.14 RUN1194, REP 44			1.342607	-0.420065	-1.275201
1194 44	4.682957	7.230120	782.909489	-35.374662	360.611739
ZOT.14 RUN1194, REP 45			3.619649	-3.566414	0.618529
1194 45	-10.991198	5.108760	789.870428	-9.652298	347.095369
ZOT.14 RUN1194, REP 46			1.109435	-0.694616	0.865075
1194 46	-7.678509	4.459772	790.084845	8.109969	338.307379
ZOT.14 RUN1194, REP 47			0.925636	0.924823	-0.038807
1194 47	-5.741013	11.073999	788.926495	3.851470	349.134880
ZOT.14 RUN1194, REP 48			3.009809	2.991007	0.335920
1194 48	12.820287	-12.650860	781.509363	-0.856615	358.881323
ZOT.14 RUN1194, REP 49			4.609209	2.682164	-3.748441
1194 49	8.859117	10.904780	778.521017	-15.634843	369.348652
ZOT.14 RUN1194, REP 50			5.732882	-5.617918	-1.142349
1194 50	-13.262376	8.489149	784.370101	-26.556215	350.612884
ZOT.14 RUN1194, REP 51			2.276654	-2.111781	-0.850615
1194 51	6.575823	2.270641	787.169011	-32.15348	350.616002
ZOT.14 RUN1194, REP 52			1.274777	1.252615	-0.236672
1194 52	9.402110	4.015879	785.309668	0.881707	347.705431
ZOT.14 RUN1194, REP 53			0.597783	-0.363042	-0.474915
1194 53	8.223923	6.071782	789.346615	-27.362446	340.563653
ZOT.14 RUN1194, REP 54			1.358842	0.902862	1.015534
1194 54	6.631388	-4.137902	785.566125	-26.224511	353.827496
ZOT.14 RUN1194, REP 55			5.719543	5.358015	2.001222
1194 55	13.059544	-10.262702	781.590483	4.790793	357.894248
ZOT.14 RUN1194, REP 56			1.983971	-1.905901	0.551077
1194 56	5.444164	5.516416	790.532115	-26.693534	346.822106
ZOT.14 RUN1194, REP 57			2.715094	-0.165908	-2.710023
1194 57	8.943717	9.163668	790.583553	-16.239424	351.245047
ZOT.14 RUN1194, REP 58			3.342724	-3.175599	1.043739
1194 58	-11.994854	-8.390233	786.566253	-6.302885	348.636566
ZOT.14 RUN1194, REP 59			3.265556	2.992104	-1.308122
1194 59	3.844865	5.212206	788.551960	9.208631	344.421113

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ZOT.14 RUN1194, REP 60                          4.339883      -2.353175      -3.646528
1194  60        -3.615383  8.623869     785.819719     -25.517808     362.228848
ZOT.14 RUN1194, REP 61                          1.192594       0.870997      -0.814646
1194  61         2.461958  2.746582     791.301180     -10.388016     345.254147
ZOT.14 RUN1194, REP 62                          1.065479      -0.989454      -0.395256
1194  62         4.257890  2.564554     792.396485     -21.009539     349.512180
ZOT.14 RUN1194, REP 63                          5.141073      -5.083712      -0.765849
1194  63        -6.106911  8.428226     789.246763     -32.296926     345.364368
ZOT.14 RUN1194, REP 64                          5.481675      -4.580439      -3.011370
1194  64        -9.009578 10.955544     781.732990      -4.287252     347.521064
ZOT.14 RUN1194, REP 65                          2.717816       2.547263      -0.947619
1194  65         9.165483  5.571905     788.013795     -12.265701     353.702453
ZOT.14 RUN1194, REP 66                          2.233637       2.215859      -0.281270
1194  66        -0.355219 -0.031419     789.856399      11.551490     350.463797
ZOT.14 RUN1194, REP 67                          3.381407      -3.376745      -0.177545
1194  67        -4.096635  7.462791     786.943410       7.447660     338.064421
ZOT.14 RUN1194, REP 68                          3.081858       2.833688      -1.211639
1194  68         0.808668  4.163288     791.592723      -0.562191     346.301443
ZOT.14 RUN1194, REP 69                          6.527886       6.443695      -1.045054
1194  69        14.433374 -0.571188     783.497537       4.919440     351.832208
ZOT.14 RUN1194, REP 70                          2.676106      -2.404350      -1.175011
1194  70       -14.502415  8.493418     784.622128      -4.595977     358.178716
ZOT.14 RUN1194, REP 71                          1.072361      -0.757964      -0.758584
1194  71        -4.420586  1.994070     789.428883      -6.152656     345.853105
ZOT.14 RUN1194, REP 72                          4.339396       0.134474      -4.337310
1194  72         1.349228  8.177698     779.956349     -26.015295     369.413937
ZOT.14 RUN1194, REP 73                          3.877618       3.691494      -1.186927
1194  73        -7.117259  5.820527     788.018679      14.032589     344.092307
ZOT.14 RUN1194, REP 74                          4.449474       4.354646      -0.913733
1194  74        -3.891894  9.409422     787.013621      20.380069     348.665368
ZOT.14 RUN1194, REP 75                          1.903162       1.823823       0.543781
1194  75        -5.991130  0.266211     784.489338      17.811234     344.684437
ZOT.14 RUN1194, REP 76                          2.662548      -2.290965      -1.356702
1194  76         8.777726 -1.500517     785.835839     -29.066947     359.726294
ZOT.14 RUN1194, REP 77                          1.592592      -1.338667       0.862741
1194  77        -4.079937  5.876032     793.035570     -13.504085     339.708025
ZOT.14 RUN1194, REP 78                          1.674830       1.339148       1.005854
1194  78        12.295367  0.864211     788.113463     -19.873432     341.649924
ZOT.14 RUN1194, REP 79                          1.492502      -1.467572       0.271653
1194  79         2.675959-10.264080     774.527130     -18.832580     373.827903
ZOT.14 RUN1194, REP 80                          4.654024       4.369707       1.601754
1194  80         9.606305 -1.322062     783.050566     -18.563874     349.084219
ZOT.14 RUN1194, REP 81                          1.558885       0.164087      -1.550225
1194  81         4.450078 -6.086682     783.879489     -11.199862     368.540856
ZOT.14 RUN1194, REP 82                          2.385347      -2.317561       0.564622
1194  82        -7.324013  4.048162     788.540144       5.495761     338.545609
ZOT.14 RUN1194, REP 83                          1.977937       1.238750      -1.541990
1194  83         8.108966  1.050475     785.233747      -3.688951     363.823420
ZOT.14 RUN1194, REP 84                          1.343585       0.867716       1.025812
1194  84        -4.079670 -9.765755     785.447450       3.928604     355.732586
ZOT.14 RUN1194, REP 85                          3.675383      -3.631335      -0.567340
1194  85        -7.908326  5.005454     792.660931     -14.354235     339.811122
ZOT.14 RUN1195                               -115.0000  -209.4   57.6      18.
ZOT.14 RUN1195, REP  1                          4.488462      -4.349937       1.106506
1195   1       -12.985013  9.433231     781.321365      -8.525605     339.796232
ZOT.14 RUN1195, REP  2                          2.317756      -0.561504       2.248713
1195   2       -10.088404-11.232046     767.511203     -11.361982     365.164483
ZOT.14 RUN1195, REP  3                          5.359173      -5.196574      -1.310104
1195   3       -11.397412  6.017086     780.660032      11.078825     328.527496
ZOT.14 RUN1195, REP  4                          5.214870       3.366542      -3.982622
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1195 4	12.785467	10.724281	778.154201	-14.731314	339.460637
ZOT.14 RUN1195. REP 5			4.907485	-0.096107	-4.906541
1195 5	-10.980203	4.360929	779.790957	-7.960955	347.991597
ZOT.14 RUN1195. REP 6			10.257079	-7.229884	-7.275747
1195 6	-4.407053	11.212072	778.886002	-4.934652	352.526360
ZOT.14 RUN1195. REP 7			6.702271	-6.702035	0.056599
1195 7	-7.590606	7.682249	784.331977	-6.574910	339.372077
ZOT.14 RUN1195. REP 8			5.962558	0.930197	-5.889552
1195 8	-5.824069	12.559229	780.206501	-17.128199	356.506386
ZOT.14 RUN1195. REP 9			6.372177	-6.182793	1.541990
1195 9	-9.578744	4.793295	787.060177	-31.720376	343.751993
ZOT.14 RUN1195. REP 10			4.810952	0.832502	-4.738375
1195 10	-9.376531	14.451897	767.406832	12.394178	371.824005
ZOT.14 RUN1195. REP 11			5.308819	3.964269	-3.531027
1195 11	5.450475	10.006578	782.816984	-24.010386	348.197687
ZOT.14 RUN1195. REP 12			7.173461	-7.164717	-0.354134
1195 12	-5.936625	-10.591883	767.308559	0.528142	365.511041
ZOT.14 RUN1195. REP 13			3.830621	-1.961710	-3.290193
1195 13	-5.668709	4.215652	780.981735	7.769488	347.981542
ZOT.14 RUN1195. REP 14			6.074700	-2.679054	-5.452031
1195 14	4.623602	2.885945	763.816503	-31.669233	378.793550
ZOT.14 RUN1195. REP 15			4.597061	-3.237459	-3.263714
1195 15	-11.410631	7.411947	775.978114	-8.638881	350.045101
ZOT.14 RUN1195. REP 16			4.817810	4.610705	-1.397392
1195 16	12.055301	7.772319	786.636681	-12.733609	358.762913
ZOT.14 RUN1195. REP 17			6.494131	6.307290	-1.546570
1195 17	6.600303	-3.348578	775.327489	-15.026332	360.669580
ZOT.14 RUN1195. REP 18			6.276488	4.323600	4.549815
1195 18	8.667505	-14.582566	780.347356	12.805712	351.152530
ZOT.14 RUN1195. REP 19			6.010530	-5.493495	-2.438852
1195 19	-14.904886	8.440521	779.658258	-17.565996	342.629347
ZOT.14 RUN1195. REP 20			8.056561	-7.666700	-2.475874
1195 20	-8.200433	9.609353	776.899102	-11.855493	347.688497
ZOT.14 RUN1195. REP 21			4.577486	-3.439877	-3.020039
1195 21	-13.067654	7.811743	784.356925	-21.024599	349.890921
ZOT.14 RUN1195. REP 22			1.977735	-1.076303	-1.659220
1195 22	-9.510222	7.482560	785.280184	-0.659403	341.578732
ZOT.14 RUN1195. REP 23			5.929435	3.302857	-4.924364
1195 23	11.793117	11.479724	778.648252	-12.113481	342.048632
ZOT.14 RUN1195. REP 24			4.177820	0.779763	-4.104406
1195 24	-1.294629	5.461961	780.309945	9.627300	362.168356
ZOT.14 RUN1195. REP 25			1.444527	-1.277385	-0.674498
1195 25	-2.646257	8.488495	779.424742	8.827056	353.658339
ZOT.14 RUN1195. REP 26			8.173751	-7.194096	-3.880106
1195 26	-12.070081	-2.718045	763.180449	-24.341077	382.102205
ZOT.14 RUN1195. REP 27			4.311015	-4.310207	-0.083545
1195 27	-6.104906	0.756783	786.775971	-32.061380	345.214740
ZOT.14 RUN1195. REP 28			8.559391	-8.542863	0.531723
1195 28	-12.811027	-8.732976	772.636328	-8.533070	360.356634
ZOT.14 RUN1195. REP 29			8.145180	3.166923	-7.504307
1195 29	13.997393	9.469170	783.997466	-0.132181	349.979839
ZOT.14 RUN1195. REP 30			2.476022	2.388569	0.652248
1195 30	11.008457	6.808767	788.644779	-16.431745	338.543119
ZOT.14 RUN1195. REP 31			10.012915	-9.155754	-4.053486
1195 31	-6.895193	7.379071	777.604215	-10.636713	344.343837
ZOT.14 RUN1195. REP 32			2.806096	2.185364	-1.760217
1195 32	-2.385494	5.870299	781.173564	-9.182468	341.336673
ZOT.14 RUN1195. REP 33			2.089329	0.977227	1.846707
1195 33	9.887572	-2.120298	786.995584	-24.413028	342.763542
ZOT.14 RUN1195. REP 34			2.679279	2.517008	0.918264

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1195  34          6.121100  1.992772     783.070971    -29.635881     340.926926
ZOT,14 RUN1195, REP 35                     10.296215     10.270692       0.724547
1195  35         10.281927 -6.392453     767.573779     -7.362491      36..640196
ZOT,14 RUN1195, REP 36                      0.639251      0.530063       0.357317
1195  36         -5.953709  8.525303     784.184089     13.069805     344.550278
ZOT,14 RUN1195, REP 37                      7.838193     -6.394437      -4.533046
1195  37         -2.866293  9.918647     774.600920     -2.800900     348.349157
ZOT,14 RUN1195, REP 38                      7.278920     -6.363559      -3.533815
1195  38         -3.852250  5.890504     777.311810     -3.825905     343.124998
ZOT,14 RUN1195, REP 39                      2.329597     -2.322742      -0.178580
1195  39        -12.665520 -4.812974     784.424476    -12.960192     355.547344
ZOT,14 RUN1195, REP 40                      5.629263     -5.532362      -1.040002
1195  40         -3.018697  2.987333     776.818693     -0.045424     353.3012 6
ZOT,14 RUN1195, REP 41                      5.871173     -2.713763      -5.206360
1195  41         -8.160403 11.365386     773.460032     -1.542855     368.209369
ZOT,14 RUN1195, REP 42                      4.681135     -4.103294      -2.253003
1195  42          3.137196 -6.654142     768.562169    -26.278711     357.503293
ZOT,14 RUN1195, REP 43                      5.347045     -2.420857      -4.767635
1195  43         -5.506808 14.389083     774.479742      8.953585     366.376972
ZOT,14 RUN1195, REP 44                      3.752175      2.769819      -2.531191
1195  44          4.869764  8.900495     773.103199    -33.147958     369.716081
ZOT,14 RUN1195, REP 45                      7.482605     -7.373178       1.275035
1195  45        -12.042855  5.557438     782.670686    -15.638409     341.991820
ZOT,14 RUN1195, REP 46                      2.625492     -2.465493       0.902530
1195  46         -3.088279  5.368090     786.342232      6.960691     335.567873
ZOT,14 RUN1195, REP 47                      1.053142      1.025306      -0.240539
1195  47         -4.586296 14.422202     780.131869      8.098947     348.473009
ZOT,14 RUN1195, REP 48                      8.657317      4.319530      -7.502721
1195  48         13.137987 10.213797     773.685732      6.998392     368.336444
ZOT,14 RUN1195, REP 49                      7.756650      5.501188      -5.468183
1195  49          9.331034 12.076386     763.619938     -5.420639     375.521982
ZOT,14 RUN1195, REP 50                      3.659845     -2.697740      -2.473193
1195  50          0.118409 11.236003     780.108408    -38.095894     353.400934
ZOT,14 RUN1195, REP 51                      1.325163     -0.540080      -1.210112
1195  51         -0.603566 -0.480113     781.373076    -24.332107     350.954397
ZOT,14 RUN1195, REP 52                      5.992603     -5.966893      -0.554554
1195  52         -8.939951  3.568489     781.105868    -15.719839     334.074452
ZOT,14 RUN1195, REP 53                      4.949622      1.810518      -4.606603
1195  53         -2.246081  7.357024     783.527084    -19.680964     355.088342
ZOT,14 RUN1195, REP 54                      3.988218      3.610792       1.693542
1195  54          4.244903 -6.611015     779.769101    -22.051266     352.244369
ZOT,14 RUN1195, REP 55                      5.220385      4.087706       3.247017
1195  55         14.566926 -3.769022     783.599316    -11.954135     333.492553
ZOT,14 RUN1195, REP 56                      3.613793     -3.480449       0.972617
1195  56          6.099270  7.804618     783.805934    -36.975166     340.581056
ZOT,14 RUN1195, REP 57                      5.105622      0.465599      -5.084347
1195  57         12.682032  9.323230     784.490727    -19.082637     355.004635
ZOT,14 RUN1195, REP 58                      6.904210     -6.902448       0.156079
1195  58        -12.739846 -7.880897     778.969580    -11.535244     346.011898
ZOT,14 RUN1195, REP 59                      3.516063     -0.013709      -3.516037
1195  59          0.246803  4.908568     782.205143     -6.306177     345.048416
ZOT,14 RUN1195, REP 60                      7.173606     -0.856628      -7.122276
1195  60        -17.884870  9.917258     774.675024     -8.896936     373.603161
ZOT,14 RUN1195, REP 61                      3.480850      1.525927      -3.128559
1195  61          3.085887  6.110378     784.103309    -10.081782     343.953372
ZOT,14 RUN1195, REP 62                      1.321366     -1.298708      -0.243654
1195  62          6.743122  0.714684     789.193113    -30.713458     347.810508
ZOT,14 RUN1195, REP 63                      6.403878     -6.287041      -1.217708
1195  63         -1.023115  7.992061     782.090523    -44.523490     343.236335
ZOT,14 RUN1195, REP 64                      8.450063     -5.440166      -6.465924
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1195 64	-11.343878	12.673286	773.744198	-11.867796	352.559292
ZOT.14 RUN1195, REP 65			5.005347	4.585969	-2.005596
1195 65	9.800278	6.248887	779.640296	-7.899870	356.075925
ZOT.14 RUN1195, REP 66			2.695315	2.694888	-0.048082
1195 66	8.866735	-3.760034	784.966690	12.271971	349.515823
ZOT.14 RUN1195, REP 67			10.263111	-10.204045	-1.099507
1195 67	0.190758	6.077421	782.201231	-1.132646	322.507426
ZOT.14 RUN1195, REP 68			8.143797	5.790477	-5.726412
1195 68	1.878500	9.768331	784.665082	9.143039	352.204271
ZOT.14 RUN1195, REP 69			3.949992	2.721064	-2.863260
1195 69	-1.919763	3.870841	784.400675	10.281138	349.082623
ZOT.14 RUN1195, REP 70			6.029471	-5.515553	-2.435823
1195 70	-16.637000	11.011184	772.204825	-10.411216	365.041922
ZOT.14 RUN1195, REP 71			3.077093	-1.418186	-2.730798
1195 71	-5.003334	3.933534	778.520477	-3.753243	343.612442
ZOT.14 RUN1195, REP 72			8.680235	2.878057	-8.189221
1195 72	2.432027	9.893460	761.327000	-24.683240	381.034786
ZOT.14 RUN1195, REP 73			5.989394	4.700683	-3.711666
1195 73	-2.091439	4.735275	780.516825	12.332631	346.656283
ZOT.14 RUN1195, REP 74			2.383586	1.520937	-1.835274
1195 74	-10.216698	11.588071	783.006321	17.918875	348.043911
ZOT.14 RUN1195, REP 75			6.136317	-5.645029	-2.405844
1195 75	-10.744888	5.165660	778.939874	8.464342	336.077911
ZOT.14 RUN1195, REP 76			3.545896	-2.794746	-2.182382
1195 76	4.456263	-7.461372	774.925686	-32.712328	366.817830
ZOT.14 RUN1195, REP 77			2.759245	-2.749851	-0.227507
1195 77	-5.166147	3.949455	787.967656	-17.594989	342.786588
ZOT.14 RUN1195, REP 78			3.088941	3.065511	0.379760
1195 78	12.258015	4.204305	779.722347	-17.956126	336.353471
ZOT.14 RUN1195, REP 79			3.095489	-3.023828	0.662212
1195 79	5.131799	-11.775201	771.564335	-26.963667	368.926918
ZOT.14 RUN1195, REP 80			8.444759	7.540107	3.802734
1195 80	10.157498	-? 539405	777.856738	-10.039155	337.395268
ZOT.14 RUN1195, REP 81			2.556096	1.066418	-2.323011
1195 81	8.209081	-8.0[illegible]045	768.896972	-11.469937	378.088569
ZOT.14 RUN1195, REP 82			6.377037	-6.065147	-1.969932
1195 82	-4.269057	7.676851	781.393723	0.761974	345.874888
ZOT.14 RUN1195, REP 83			3.860677	2.095382	-3.242560
1195 83	13.141490	-1.434404	769.174012	1.189993	373.159032
ZOT.14 RUN1195, REP 84			1.259027	1.153259	0.505120
1195 84	-5.267178	2.692153	786.309257	13.189372	332.917183
ZOT.14 RUN1195, REP 85			7.401817	-6.641568	-3.267490
1195 85	-11.862541	6.903776	787.049198	-19.457382	343.332978

Example Output

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PROGRAM FOR STATISTICAL ANALYSIS OF GUIDANCE ERROR
AND ESTIMATING PROBABILITY OF HITTING A VEHICULAR TARGET

VEHICULAR TARGET REPRESENTED BY 66 CONVEX QUADRILATERAL FACETS WITH CORNER COORDINATES BY FACET:

-132.00	81.95	0.0	-132.00	76.00	-38.00	-173.98	77.16	-13.39	-178.00	79.00	0.0
-132.00	81.95	0.0	-100.00	84.00	0.0	-107.35	79.09	-28.35	-132.00	76.00	-38.00
-132.00	81.95	0.0	-132.00	76.00	38.00	-107.35	79.09	28.35	-100.00	84.00	0.0
-132.00	81.95	0.0	-178.00	79.00	0.0	-173.98	77.16	13.39	-132.00	76.00	38.00
-191.00	57.00	0.0	-178.00	79.00	0.0	-173.98	77.16	-13.39	-183.00	57.00	-21.00
-183.00	57.00	-21.00	-173.98	77.16	-13.39	-132.00	76.00	-38.00	-132.00	57.00	-50.00
-132.00	57.00	-50.00	-132.00	76.00	-38.00	-107.35	79.09	-28.35	-100.00	57.00	-40.00
-100.00	57.00	-40.00	-107.35	79.09	-28.35	-100.00	84.00	0.0	-86.00	57.00	0.0
-86.00	57.00	0.0	-100.00	84.00	0.0	-107.35	79.09	28.35	-100.00	57.00	40.00
-100.00	57.00	40.00	-107.35	79.09	28.35	-132.00	76.00	38.00	-132.00	57.00	50.00
-132.00	57.00	50.00	-132.00	76.00	38.00	-173.98	77.16	13.39	-183.00	57.00	21.00
-183.00	57.00	21.00	-173.98	77.16	13.39	-178.00	79.00	0.0	-191.00	57.00	0.0
-198.00	57.00	10.00	-198.00	68.00	10.00	-198.00	68.00	-10.00	-198.00	57.00	-10.00
-198.00	68.00	10.00	-178.00	80.00	10.00	-178.00	80.00	-10.00	-198.00	68.00	-10.00
-178.00	80.00	10.00	-174.00	80.00	10.00	-174.00	80.00	-10.00	-178.00	80.00	-10.00
-198.00	57.00	10.00	-178.00	57.00	10.00	-178.00	80.00	10.00	-198.00	68.00	10.00
-178.00	57.00	10.00	-174.00	57.00	10.00	-174.00	80.00	10.00	-178.00	80.00	10.00
-198.00	57.00	-10.00	-198.00	68.00	-10.00	-178.00	80.00	-10.00	-178.00	57.00	-10.00
-178.00	57.00	-10.00	-178.00	80.00	-10.00	-174.00	80.00	-10.00	-174.00	57.00	-10.00
-174.00	80.00	10.00	-174.00	57.00	10.00	-174.00	57.00	-10.00	-174.00	80.00	-10.00
-212.00	0.0	64.00	-244.00	48.00	64.00	-255.00	43.00	64.00	-251.00	23.00	64.00
-212.00	0.0	64.00	-58.00	0.0	64.00	-24.00	48.00	64.00	-244.00	48.00	64.00
-58.00	0.0	64.00	-28.00	16.00	64.00	-9.00	35.00	64.00	-24.00	48.00	64.00
-24.00	48.00	64.00	-24.00	57.00	64.00	-216.00	57.00	64.00	-216.00	48.00	64.00
-212.00	0.0	40.00	-251.00	23.00	40.00	-255.00	43.00	40.00	-244.00	48.00	40.00
-212.00	0.0	40.00	-244.00	48.00	40.00	-24.00	48.00	40.00	-58.00	0.0	40.00
-58.00	0.0	40.00	-24.00	48.00	40.00	-9.00	35.00	40.00	-28.00	16.00	40.00
-24.00	48.00	40.00	-216.00	48.00	40.00	-216.00	57.00	40.00	-24.00	57.00	40.00

-212.00	0.0	64.00	-251.00	23.00	64.00	-251.00	23.00	40.00	-212.00	0.0	40.00
-251.00	23.00	64.00	-255.00	43.00	64.00	-255.00	43.00	40.00	-251.00	23.00	40.00
-255.00	43.00	64.00	-244.00	48.00	64.00	-244.00	48.00	40.00	-255.00	43.00	40.00
-244.00	48.00	64.00	-216.00	48.00	64.00	-216.00	48.00	40.00	-244.00	48.00	40.00
-216.00	48.00	64.00	-216.00	57.00	64.00	-216.00	57.00	40.00	-216.00	48.00	40.00
-216.00	57.00	64.00	-24.00	57.00	64.00	-24.00	57.00	40.00	-216.00	57.00	40.00
-24.00	57.00	64.00	-24.00	48.00	64.00	-24.00	48.00	40.00	-24.00	57.00	40.00
-24.00	48.00	64.00	-9.00	35.00	64.00	-9.00	35.00	40.00	-24.00	48.00	40.00
-9.00	35.00	64.00	-28.00	16.00	64.00	-28.00	16.00	40.00	-9.00	35.00	40.00
-28.00	16.00	64.00	-58.00	0.0	64.00	-58.00	0.0	40.00	-28.00	16.00	40.00
-212.00	0.0	-40.00	-244.00	48.00	-40.00	-255.00	43.00	-40.00	-251.00	23.00	-40.00
-212.00	0.0	-40.00	-58.00	0.0	-40.00	-24.00	48.00	-40.00	-244.00	48.00	-40.00
-58.00	0.0	-40.00	-28.00	16.00	-40.00	-9.00	35.00	-40.00	-24.00	48.00	-40.00
-24.00	48.00	-40.00	-24.00	57.00	-40.00	-216.00	57.00	-40.00	-216.00	48.00	-40.00
-212.00	0.0	-64.00	-251.00	23.00	-64.00	-255.00	43.00	-64.00	-244.00	48.00	-64.00
-212.00	0.0	-64.00	-244.00	48.00	-64.00	-24.00	48.00	-64.00	-58.00	0.0	-64.00
-58.00	0.0	-64.00	-24.00	48.00	-64.00	-9.00	35.00	-64.00	-28.00	16.00	-64.00
-24.00	48.00	-64.00	-216.00	48.00	-64.00	-216.00	57.00	-64.00	-24.00	57.00	-64.00
-212.00	0.0	-40.00	-251.00	23.00	-40.00	-251.00	23.00	-64.00	-212.00	0.0	-64.00
-251.00	23.00	-40.00	-255.00	43.00	-40.00	-255.00	43.00	-64.00	-251.00	23.00	-64.00
-255.00	43.00	-40.00	-244.00	48.00	-40.00	-244.00	48.00	-64.00	-255.00	43.00	-64.00
-244.00	48.00	-40.00	-216.00	48.00	-40.00	-216.00	48.00	-64.00	-244.00	48.00	-64.00
-216.00	48.00	-40.00	-216.00	57.00	-40.00	-216.00	57.00	-64.00	-216.00	48.00	-64.00
-216.00	57.00	-40.00	-24.00	57.00	-40.00	-24.00	57.00	-64.00	-216.00	57.00	-64.00
-24.00	57.00	-40.00	-24.00	48.00	-40.00	-24.00	48.00	-64.00	-24.00	57.00	-64.00
-24.00	48.00	-40.00	-9.00	35.00	-40.00	-9.00	35.00	-64.00	-24.00	48.00	-64.00
-9.00	35.00	-40.00	-28.00	16.00	-40.00	-28.00	16.00	-64.00	-9.00	35.00	-64.00
-28.00	16.00	-40.00	-58.00	0.0	-40.00	-58.00	0.0	-64.00	-28.00	16.00	-64.00
-236.00	17.00	40.00	-200.00	57.00	40.00	-212.00	57.00	40.00	-254.40	40.00	40.00
-46.00	17.00	40.00	-28.00	26.00	40.00	-19.00	53.00	40.00	-24.00	57.00	40.00

-236.00	17.00	-40.00	-254.40	40.00	-40.00	-212.00	57.00	-40.00	-200.00	57.00	-40.00
-46.00	17.00	-40.00	-24.00	57.00	-40.00	-19.00	53.00	-40.00	-28.00	26.00	-40.00
-236.00	17.00	40.00	-254.40	40.00	40.00	-254.40	40.00	-40.00	-236.00	17.00	-40.00
-254.40	40.00	40.00	-212.00	57.00	40.00	-212.00	57.00	-40.00	-254.40	40.00	-40.00
-212.00	57.00	40.00	-24.00	57.00	40.00	-24.00	57.00	-40.00	-212.00	57.00	-40.00
-24.00	57.00	40.00	-19.00	53.00	40.00	-19.00	53.00	-40.00	-24.00	57.00	-40.00
-19.00	53.00	40.00	-28.00	16.00	40.00	-28.00	16.00	-40.00	-19.00	53.00	-40.00
-28.00	16.00	40.00	-58.00	0.0	40.00	-58.00	0.0	-40.00	-28.00	16.00	-40.00

ABOVE COORDINATES IN INCHES. 1ST COORDINATE IS DIST FORWARD FROM TRAILING EDGE TIMES -1, 2ND HEIGHT ABOVE GROUND, 3RD DIST TO DRIVERS LEFT FROM CENTERLINE

SUPPLEMENTARY NAVY RUNS -- T2 AT 12 KM GTR, DR = 1, 2, 4 KM. -- 30 AUG 1976

3 SETS OF SAMPLE SIZE 85 VARYING PARAMETER KM DESIGNATION RANGE
SQUARE TARGET WIDTH 7.500 FT
ANALYSIS CONTROL PARAMETER IALPHA = 3
POLYNOMIAL-FIT CONTROL PARAMETER NGO = 0

RESULTS FOR 1.000 KM DESIGNATION RANGE

TARGET HEADING -115.00 DEGREES IN ZOT COORDINATE SYSTEM
DESIGNATION POINT IN FACET COORDINATES -209.40 57.60 18.00

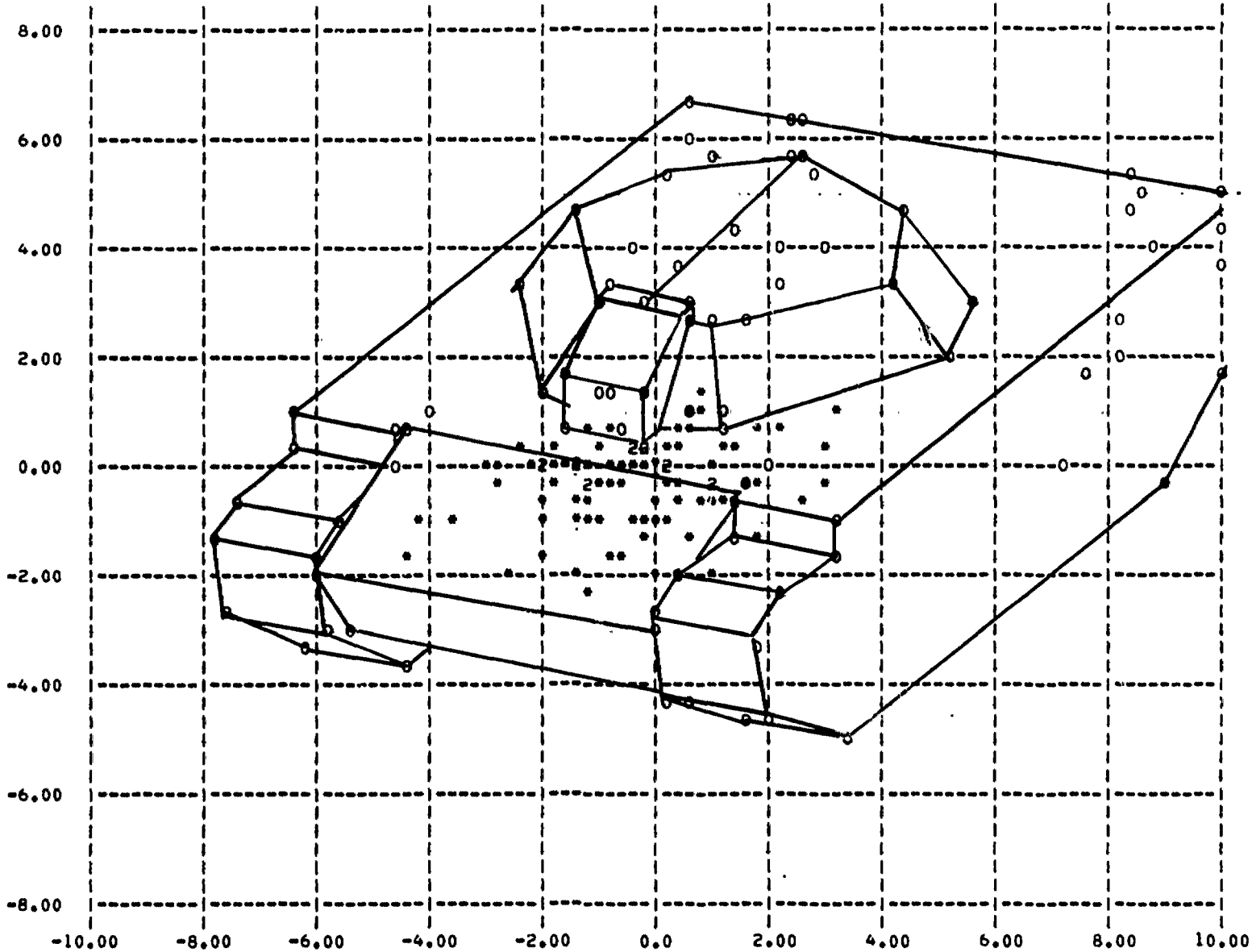
OUTCOMES OF INDIVIDUAL REPLICATIONS:

REP	YAW	PITCH	FACET NO.	OBLIQUITY (DEG)	ALPHA.Y	ALPHA.P	PHI.V	THETA.V	AIRSPEED (FPS)	BETA.Y	BETA.P
1	-1.3856	-0.0083	62	50.3900	-11.0447	4.8642	90.3212	-23.8543	864.7996	-11.3317	4.8610
2	-2.7103	0.0731	62	38.2910	-9.9705	-6.6241	91.2292	-24.5803	865.4136	-9.4301	-7.3532
3	3.0712	-0.3591	34	73.7028	10.1853	6.9783	89.6254	-23.5877	861.8569	9.2601	7.2418
4	0.6118	1.1028	12	19.3601	10.5093	6.1103	91.2268	-23.1142	861.8872	11.0536	6.8473
5	-2.9065	-0.1033	62	52.2496	-12.0691	6.2431	90.3169	-23.3502	859.5317	-12.3611	6.7441
6	-0.1329	0.0399	63	73.3147	-8.0804	6.2720	89.4691	-23.2630	860.8640	-9.1515	6.8601
7	-1.2982	-0.2704	62	51.4206	-10.2345	5.7305	89.9803	-23.7065	864.0374	-10.8339	5.8751
8	-0.7948	-1.6501	62	56.4281	2.2954	9.0284	91.4304	-23.8865	865.7910	3.0227	8.9930
9	-1.8733	0.0960	62	50.7723	-4.7077	4.5511	91.0855	-23.7657	866.6812	-4.2954	4.6365
10	1.8956	-1.4227	32	74.3251	3.5566	8.5786	89.7975	-24.2817	866.3281	2.7933	8.1480
11	-0.4145	-0.9485	62	59.0819	9.6135	9.2914	91.8744	-23.6514	863.2917	10.7488	9.4911
12	-1.1419	-0.3735	62	43.8318	-9.1984	-1.2513	89.7070	-24.3595	864.4270	-10.0437	-1.7597
13	0.7261	-0.5074	62	53.8382	-8.5639	7.8572	89.4036	-23.4655	862.2976	-9.6935	8.2428
14	-2.5169	-1.8821	62	53.4687	8.3772	4.6151	92.2312	-24.6103	864.9548	9.8284	3.8559
15	-1.2767	-1.0107	62	53.8701	-9.6884	8.2381	90.3427	-23.8009	864.3169	-9.9558	8.2883
16	0.7301	0.9561	12	16.9333	8.6028	4.8717	91.0382	-23.1735	863.5073	8.9735	5.5494
17	0.3652	-0.6332	62	52.2376	9.3147	2.5539	91.8924	-24.0995	863.5291	10.4625	2.3056
18	0.8950	1.2450	12	9.4414	4.9539	-8.2098	90.3502	-24.1909	865.7622	4.6941	-8.5496
19	-1.9808	-0.7367	62	54.3845	-9.1429	8.5393	90.7970	-23.6414	864.7737	-8.9945	8.7490
20	-1.9797	-0.8714	62	52.8345	-10.7555	7.3119	90.1162	-23.8595	863.4158	-11.2298	7.3036
21	-1.1393	0.6943	13	26.9051	-7.0212	3.1248	90.8242	-23.3184	864.3384	-6.8474	3.6576
22	-0.4114	0.0599	63	69.2614	-7.9527	2.5719	90.3187	-23.5661	865.0310	-8.2426	2.8569
23	0.5874	0.8309	12	17.4957	10.5674	2.6361	91.3094	-23.2307	861.5405	11.1873	3.2566
24	-0.0597	-1.8402	62	53.1336	-0.8274	6.9219	90.3114	-24.2653	867.6841	-1.1223	6.5078
25	1.0270	-0.4674	62	51.5632	-6.8240	5.9899	89.2776	-23.9882	863.4631	-8.0641	5.8528
26	-4.4215	-1.5768	62	45.8081	-11.5353	1.2204	91.4366	-24.8146	865.9990	-10.8077	0.2570
27	-1.3798	-0.0848	62	49.4311	-2.7715	2.8352	91.1050	-23.7204	866.6484	-2.3412	2.9659
28	-1.9044	-0.1174	62	45.1734	-11.9094	0.0053	90.1171	-24.1890	865.0249	-12.3818	-0.3325
29	0.4950	0.2318	63	73.4982	7.4347	6.5016	90.7128	-23.2089	863.5745	7.5063	7.1438
30	0.2595	-0.1356	63	71.7515	5.5383	5.3097	90.9626	-23.6840	866.2781	5.8384	5.4768
31	-1.6151	-0.0241	62	53.8255	-9.3171	7.7213	89.9225	-23.3280	860.9941	-9.9713	8.2444
32	-1.8806	-0.3369	62	54.4462	-7.2129	8.2412	91.2890	-23.4758	863.8215	-6.6131	8.6165
33	-0.2543	0.3357	63	64.4430	8.1573	-1.7557	91.3126	-24.1020	866.3428	8.7759	-2.0066
34	-2.3333	0.3142	63	69.5394	6.4587	2.9137	92.4139	-23.6200	862.6414	8.0886	3.1448
35	1.7035	-0.3264	34	67.6592	11.2693	1.4674	91.3991	-24.3533	864.7937	11.9655	0.9652
36	-0.0893	-0.1645	62	52.4982	-4.1879	6.3396	90.1937	-23.7710	866.3242	-4.5917	6.4198
37	0.0166	-0.9702	62	55.3511	-4.0446	9.2652	89.3423	-23.7404	860.8037	-5.2278	9.3760
38	0.4187	-0.4596	62	54.0443	-4.4611	7.7617	89.2915	-23.4986	860.0728	-5.6932	8.1142
39	-0.8255	-0.2964	62	48.3587	-4.8702	2.3976	90.7700	-23.9861	867.4517	-4.7468	2.2626
40	0.0833	-0.5639	62	49.4781	-6.7719	3.9152	89.3910	-24.0191	863.3467	-7.9082	3.7472
41	-0.6623	-1.5393	62	52.4744	-9.8515	7.2627	90.1199	-24.2054	865.9541	-10.3213	6.9084
42	-3.6954	-1.0434	62	44.2865	-7.0322	-0.9531	91.5768	-24.5536	866.3022	-6.1755	-1.6556
43	0.5999	-1.4432	62	54.0378	-7.4803	8.6747	89.4397	-24.1528	865.0005	-8.5709	8.3730
44	-0.9212	-0.8990	62	54.2389	4.2445	6.4798	91.9657	-24.2444	865.9636	5.4578	6.0866
45	-2.1132	0.0246	62	50.7605	-7.0986	4.8778	90.6816	-23.7726	866.0461	-7.0559	4.9564
46	-0.3587	0.3913	63	71.2770	-8.0687	4.4401	89.8664	-23.4485	863.9805	-8.7737	4.8428
47	0.1344	-0.2790	62	55.7250	-3.0944	9.4622	90.2223	-23.7907	865.9307	-3.4720	9.5226
48	1.2932	0.4994	63	55.5855	9.7193	-10.3129	90.5492	-24.4919	864.1577	9.6413	-10.9536
49	0.9710	-2.1542	32	74.3745	5.7986	8.8111	91.0048	-24.5729	866.9341	6.1349	8.0893
50	-4.1739	-0.8616	62	52.4556	-12.7216	7.0302	91.3367	-23.9356	863.3721	-12.0802	6.9457

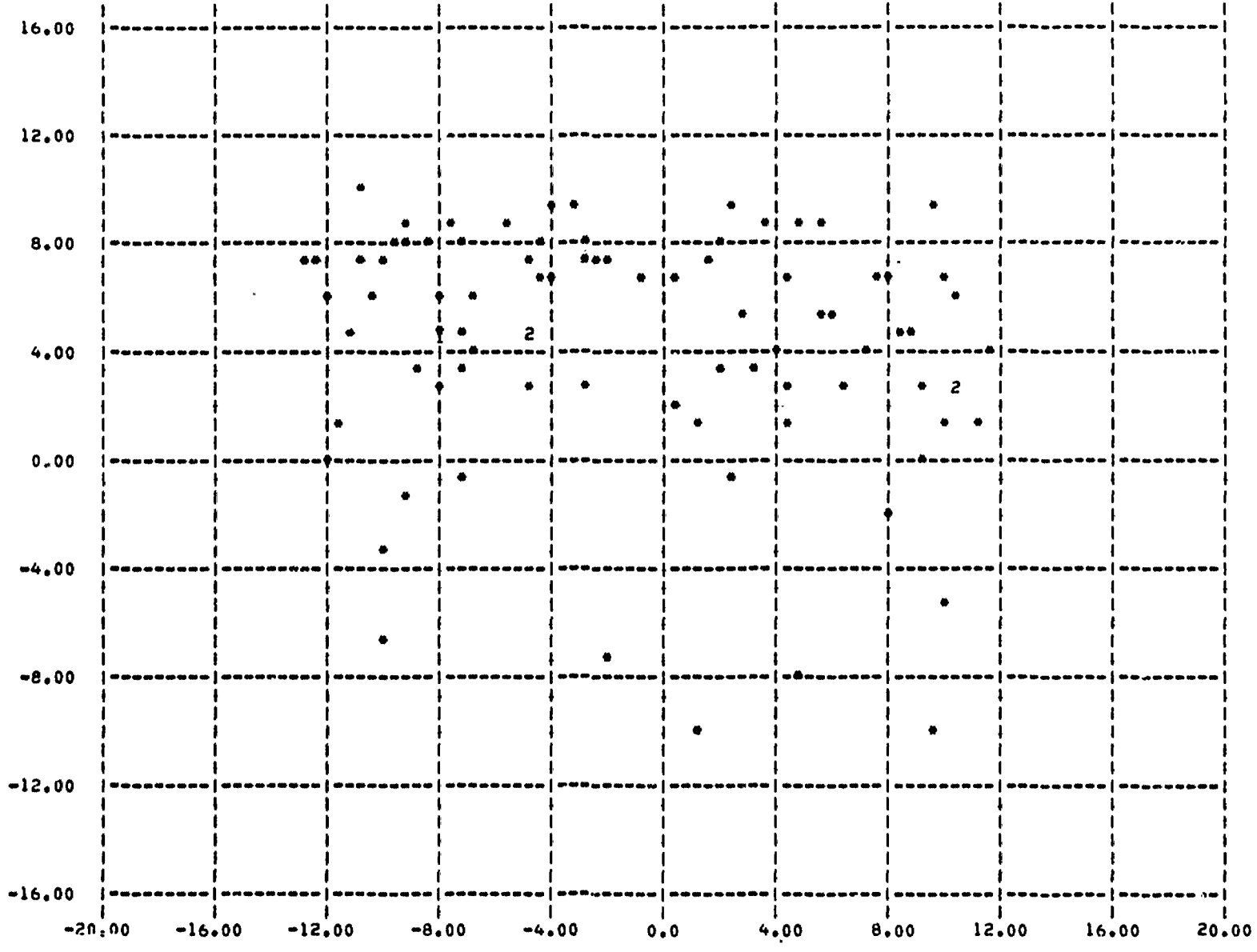
51	-1.2333	-0.5594	62	51.1140	3.0282	3.3407	91.5557	-23.9057	866.4121	3.8700	3.2861
52	0.9923	-0.1004	63	70.5893	7.3078	4.2595	90.2933	-23.8526	864.6885	6.9953	4.2581
53	-0.3345	0.2286	63	70.8904	4.1201	4.1518	91.3810	-23.9472	864.2781	4.8051	4.6557
54	-0.1820	0.2256	63	66.4612	9.2107	0.0953	91.7123	-24.0336	865.0117	10.1946	-0.0872
55	2.2923	0.7037	63	60.6405	9.9099	-5.4230	90.3480	-24.3110	865.3816	9.6484	-5.8829
56	-1.2928	-0.0112	62	52.8222	2.7742	5.0677	91.3569	-23.7477	866.4080	3.4351	5.1711
57	-0.2629	-1.4327	62	56.7742	4.9968	8.7045	90.9935	-23.7969	866.5051	5.3249	8.7588
58	-1.8203	0.3484	63	63.5401	-9.9929	-3.0064	90.4365	-23.8606	864.8499	-10.1744	-3.0158
59	1.1830	-0.7287	62	55.3682	1.9962	7.9122	90.0289	-23.4950	864.5095	1.4404	8.2684
60	-1.3355	-1.9318	62	53.5103	-2.1043	7.3572	91.3051	-24.2496	867.6138	-1.4932	6.9586
61	0.1319	-0.1398	63	74.1235	1.4620	7.4035	90.7496	-23.2888	864.4255	1.5673	7.9658
62	-0.6661	-0.3381	62	51.1412	2.1810	3.5915	91.1439	-23.8046	867.2273	2.6466	3.6380
63	-2.7134	-0.4968	62	53.9558	-4.6269	7.6068	91.5058	-23.6718	865.6221	-3.8293	7.7861
64	-2.0481	-1.6823	62	55.5085	-10.7789	9.9085	89.9634	-23.7761	860.9561	-11.3935	9.9835
65	0.9407	-0.7535	62	53.5705	6.1584	5.2542	90.8715	-23.9876	866.5396	6.3745	5.1177
66	0.9404	-0.2784	63	68.2976	0.3210	2.1704	89.9740	-23.8730	866.7566	-0.2835	2.1485
67	-0.6481	0.0474	63	75.2185	-5.6899	8.4418	89.4271	-23.3897	860.6296	-6.7985	8.9032
68	1.4146	0.2453	63	73.7267	0.4889	6.9977	90.4028	-23.2712	864.4385	0.2756	7.5776
69	3.2398	1.0312	63	71.1615	11.4232	3.9309	90.3497	-23.2315	861.9287	11.1611	4.5506
70	-1.3633	-0.8729	62	52.2447	-12.3553	7.0589	90.2909	-24.1672	865.3284	-12.6692	6.7428
71	-0.7205	-0.0938	62	53.9462	-2.2806	7.0251	90.6082	-23.3348	864.1265	-2.3051	7.5415
72	-1.1905	-2.4448	62	55.5377	7.9650	6.9425	92.1307	-24.5644	864.9614	9.3254	6.2292
73	1.5819	-0.4457	34	73.1451	-4.2442	6.4740	89.8030	-23.4206	863.8777	-5.0076	6.9046
74	2.5547	-0.7334	34	73.9837	-2.6037	7.7618	89.2325	-23.8329	864.6389	-3.8866	7.7800
75	2.9269	0.3844	34	67.2137	1.2285	1.0650	89.1310	-23.8512	862.9155	-0.1470	1.0649
76	-1.3056	-0.8033	62	49.5250	4.3774	1.6181	91.4453	-24.1980	867.5015	5.1166	1.2712
77	-1.0046	0.4810	63	74.1864	-2.6325	7.4307	90.8537	-23.2656	864.5750	-2.4315	8.0162
78	0.2358	0.2210	63	69.4649	10.5846	2.6237	91.3051	-23.6298	864.1187	11.1985	2.8450
79	-1.0847	-0.4031	62	36.5809	1.1472	-9.9011	91.0704	-25.1282	865.8938	1.5414	-11.1781
80	1.7750	0.8132	63	67.9563	9.9698	1.4505	91.5187	-23.9356	863.0354	10.7775	1.3660
81	-0.1035	-0.9111	62	46.2129	2.2002	-0.7310	90.7916	-24.4978	868.3398	2.3427	-1.3776
82	-0.8585	0.6814	13	24.5289	-8.9696	3.4891	89.7034	-23.3070	861.6609	-9.8251	4.0332
83	0.2725	-1.0543	62	50.3309	4.3063	2.8663	90.5184	-24.3368	867.6936	4.2001	2.3806
84	0.4329	0.6782	63	57.9997	-1.9597	-7.5612	90.2351	-24.4613	865.7930	-2.3237	-8.1714
85	-1.9749	0.1179	62	51.4387	-4.6884	4.7326	90.8663	-23.2490	864.4150	-4.4758	5.3347

RESULTS FOR 1.000 KM DESIGNATION RANGE

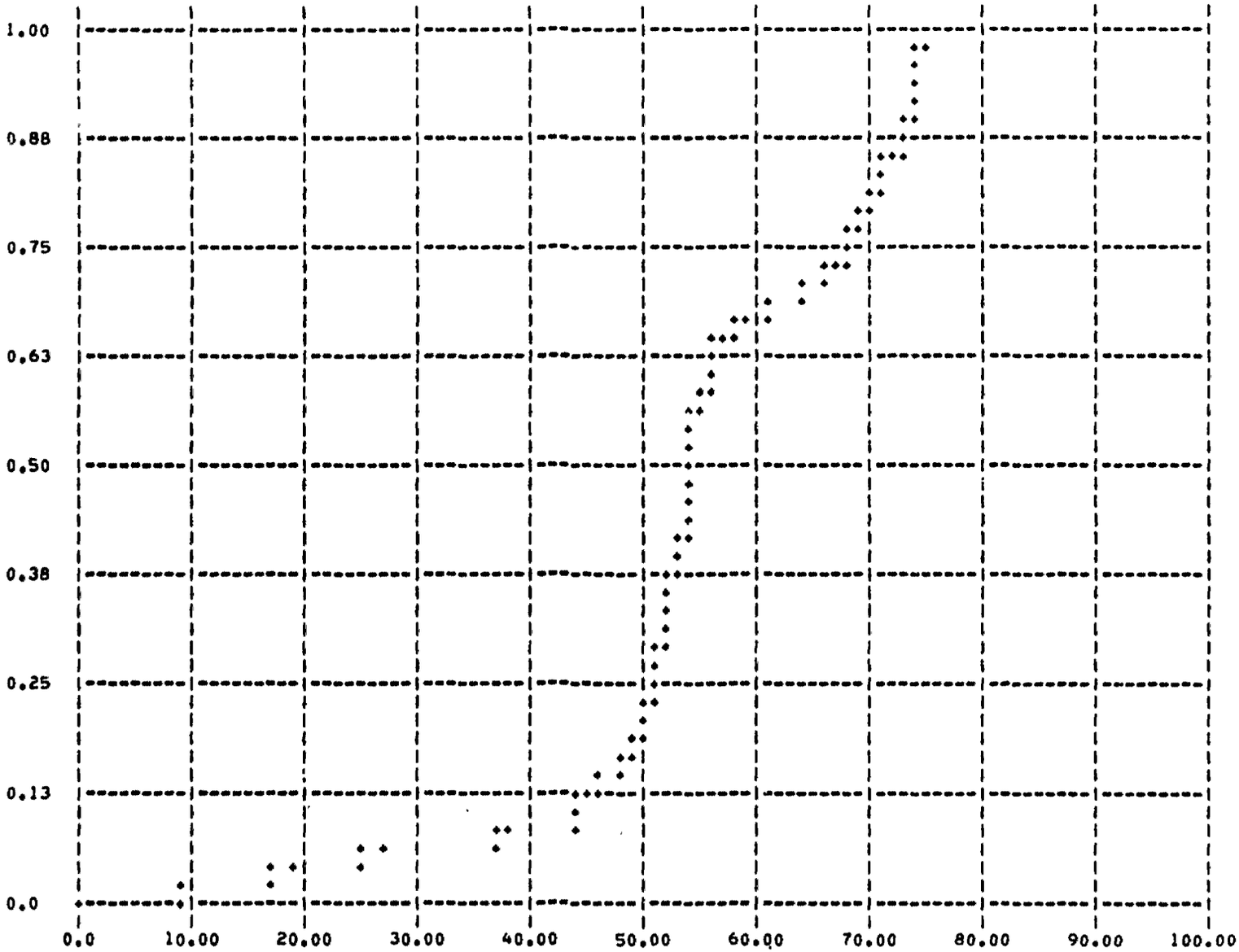
TARGET HEADING -115.00 DEGREES IN ZOT COORDINATE SYSTEM
DESIGNATION POINT IN FACET COORDINATES -209.40 57.60 18.00



IMPACT-PLANE SCATTER PLOT OF IMPACTS AND TARGET CORNERS RELATIVE TO DESIGNATION POINT



FREQUENCY PLOT OF TERMINAL ANGLES OF ATTACK



CUMULATIVE SAMPLE DISTRIBUTION OF IMPACT OBLIQUITIES

PERCENTILES:																		
RANK	.05	.10	.15	.20	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70	.75	.80	.85	.90	.95
DEVIATE (D	20.9	41.6	46.2	49.7	50.9	51.5	52.5	53.0	53.7	54.0	54.4	55.5	56.7	63.7	67.8	69.5	71.3	73.6	74.2

RESULTS FOR 1.000 KM DESIGNATION RANGE

OUTCOMES:	NUMBER	FRACTION
FAILED TO ACQUIRE	0	0.0
ACQUIRED BUT MISSED	0	0.0
ACQUIRED AND HIT	85	1.00000

APPROXIMATE PROBABILITY OF TARGET BEING IN ACQUISITION FOOTPRINT: 1.00000

	MISS DIST	YAW ERROR (FEET)	PITCH ERROR	PHI.V (DEGREES)	THETA.V	SPEED (FPS)	ALPHA.Y (DEGREES)	ALPHA.P
MEANS	1.5503	-0.3999	-0.3468	90.6349	-23.8511	864.5874	-0.9139	4.1978
STD DEVS	0.9401	1.5527	0.7882	0.8141	0.4475	2.3951	7.4462	4.4849

*NOTE: PHI.V MEASURED CCW FROM +Z-AXIS IN ZOT SYSTEM.

YAW-PITCH CORRELATION 0.2570
SQUARE TARGET HIT PROBABILITIES: APPROX 0.97647, DERIVED 0.98075 GIVEN ACQUISITION.
EQUIVALENT CIRCULAR-NORMAL STD DEV 1.44918 FT
VEHICULAR TARGET HIT PROBABILITY: APPROX 1.00000 GIVEN ACQUISITION.
ANGLE-OF-ATTACK CORRELATIONS: ALPHA.Y-ALPHA.P -0.1832 ALPHA.Y-ERR.Y 0.5668 ALPHA.P-ERR.P -0.4384
OBLIQUITY MEAN 55.4322, STD. DEV. 13.9178 DEG

SORTED MISS DISTANCES (FT)

0.1387	0.1871	0.1923	0.2899	0.2928	0.3097	0.3232	0.4051	0.4158	0.4211
0.5308	0.5466	0.5700	0.6217	0.6498	0.7266	0.7310	0.7470	0.8046	0.8770
0.8858	0.9169	0.9704	0.9808	0.9974	1.0176	1.0351	1.0889	1.0960	1.1138
1.1284	1.1572	1.2014	1.2030	1.2053	1.2611	1.2872	1.2928	1.3261	1.3342
1.3542	1.3825	1.3856	1.3863	1.3894	1.4357	1.4566	1.5329	1.5333	1.5629
1.6153	1.6188	1.6283	1.6435	1.6757	1.7345	1.8316	1.8412	1.8533	1.8757
1.9080	1.9105	1.9524	1.9784	2.1134	2.1134	2.1630	2.3485	2.3544	2.3629
2.3701	2.3979	2.6504	2.6579	2.7113	2.7192	2.7585	2.9084	2.9521	3.0921
3.1428	3.3999	3.8399	4.2619	4.6943					

SORTED YAW ERRORS (FT)

-4.4215	-4.1739	-3.6954	-2.9065	-2.7134	-2.7103	-2.5169	-2.3333	-2.1132	-2.0481
-1.9808	-1.9797	-1.9749	-1.9044	-1.8806	-1.8733	-1.8203	-1.6151	-1.3856	-1.3798
-1.3633	-1.3355	-1.3056	-1.2982	-1.2928	-1.2767	-1.2333	-1.1905	-1.1419	-1.1393
-1.0847	-1.0046	-0.9212	-0.8585	-0.8255	-0.7948	-0.7205	-0.6661	-0.6623	-0.6481
-0.4145	-0.4114	-0.3587	-0.3345	-0.2629	-0.2543	-0.1820	-0.1329	-0.1035	-0.0893
-0.0597	0.0166	0.0833	0.1319	0.1344	0.2358	0.2595	0.2725	0.3652	0.4187
0.4329	0.4950	0.5874	0.5999	0.6118	0.7261	0.7301	0.8950	0.9404	0.9407
0.9710	0.9923	1.0270	1.1830	1.2932	1.4146	1.5819	1.7035	1.7750	1.8956
2.2923	2.5547	2.9269	3.0712	3.2398					

SORTED PITCH ERRORS (FT)

-2.4448	-2.1542	-1.9318	-1.8821	-1.8402	-1.6823	-1.6501	-1.5768	-1.5393	-1.4432
-1.4327	-1.4227	-1.0543	-1.0434	-1.0107	-0.9702	-0.9485	-0.9111	-0.8990	-0.8729
-0.8714	-0.8616	-0.8033	-0.7535	-0.7367	-0.7334	-0.7287	-0.6332	-0.5639	-0.5594
-0.5074	-0.4968	-0.4674	-0.4596	-0.4457	-0.4031	-0.3735	-0.3591	-0.3381	-0.3369
-0.3264	-0.2964	-0.2790	-0.2784	-0.2704	-0.1645	-0.1398	-0.1356	-0.1174	-0.1033
-0.1004	-0.0938	-0.0848	-0.0241	-0.0112	-0.0083	0.0246	0.0399	0.0474	0.0599
0.0731	0.0960	0.1179	0.2210	0.2256	0.2286	0.2318	0.2453	0.3142	0.3357
0.3484	0.3844	0.3913	0.4810	0.4994	0.6782	0.6814	0.6943	0.7037	0.8132
0.8309	0.9561	1.0312	1.1028	1.2450					

SORTED OBLIQUITIES (DEG):

9.4414	16.9333	17.4957	19.3601	24.5289	26.9051	36.5809	38.2910	43.8318	44.2865

45.1734	45.8081	46.2129	48.3587	49.4311	49.4781	49.5250	50.3309	50.3900	50.7605
50.7723	51.1140	51.1412	51.4206	51.4387	51.5632	52.2376	52.2447	52.2496	52.4556
52.4744	52.4982	52.8222	52.8345	53.1336	53.4687	53.5103	53.5705	53.8255	53.8382
53.8701	53.9462	53.9558	54.0378	54.0443	54.2389	54.3845	54.4462	55.3511	55.3682
55.5085	55.5377	55.5855	55.7250	56.4281	56.7742	57.9997	59.0819	60.6405	63.5401
64.4430	66.4612	67.2137	67.6592	67.9563	68.2976	69.2614	69.4649	69.5394	70.5893
70.8904	71.1615	71.2770	71.7515	73.1451	73.3147	73.4982	73.7028	73.7267	73.9837
74.1235	74.1864	74.3251	74.3745	75.2185					

NUMBER OF IMPACTS BY FACET:

FACET NO.	NO. OF IMPACTS
62	50
63	22
34	5
12	4
13	2
32	2

RESULTS FOR 2.000 KM DESIGNATION RANGE

TARGET HEADING -115.00 DEGREES IN ZOT COORDINATE SYSTEM
DESIGNATION POINT IN FACET COORDINATES -209.40 57.60 18.00

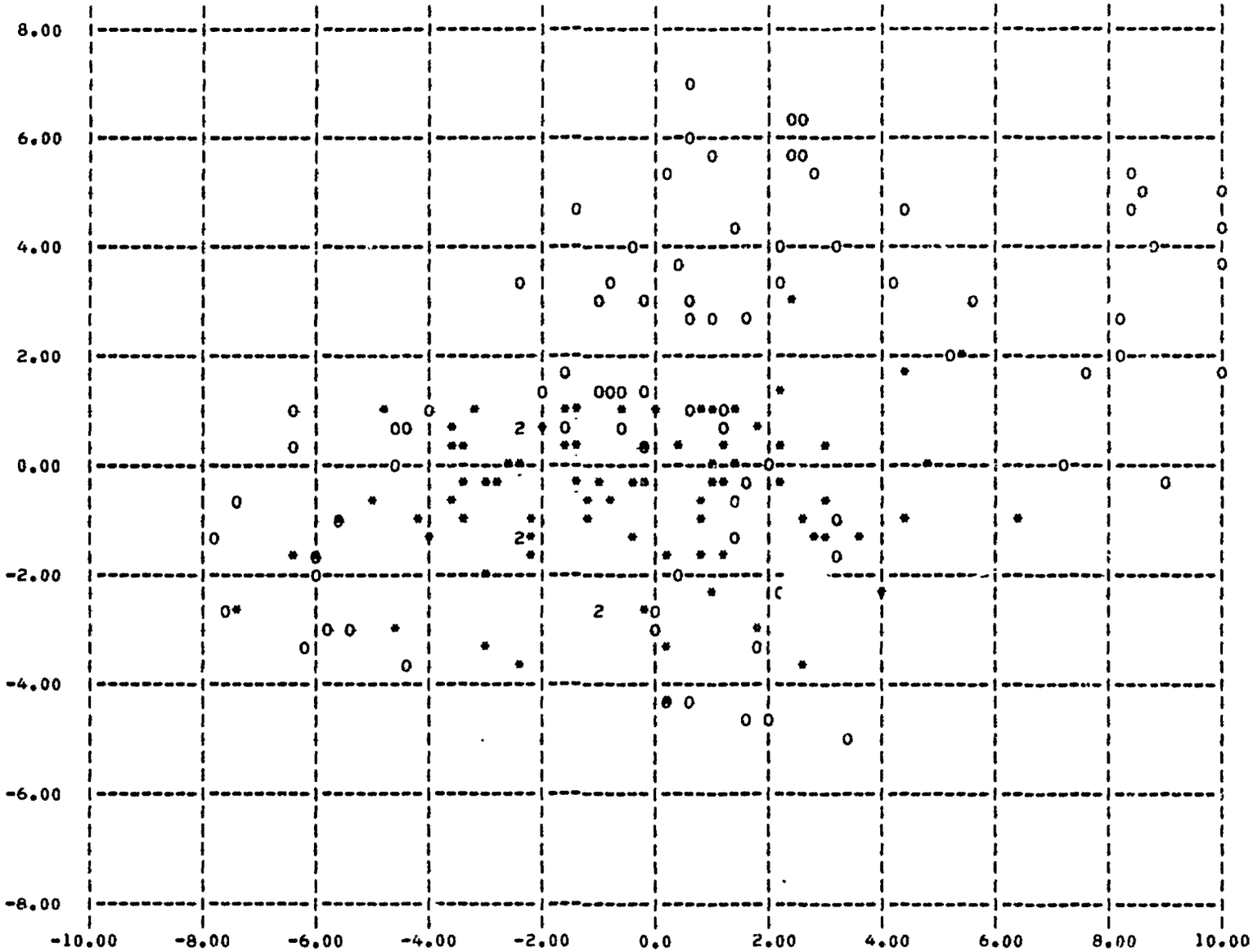
OUTCOMES OF INDIVIDUAL REPLICATIONS:

REP	YAW	PITCH	FACET NO.	OBLIQUITY (DEG)	ALPHA.Y	ALPHA.P	PHI.V	THETA.V	AIRSPEED (FPS)	BETA.Y	BETA.P
1	-2.3605	0.5705	63	72.0759	-12.6978	5.3280	90.3236	-23.8811	860.9319	-13.0182	5.4971
2	-4.7378	0.8482	52	53.9368	-14.7334	-11.7203	91.8684	-25.1427	858.0916	-13.6522	-12.8129
3	-0.1835	-0.1811	62	56.9757	11.1715	6.6163	90.8912	-23.4524	855.7788	11.3708	7.2140
4	1.3622	-0.0897	63	70.2258	12.2715	3.0224	91.3306	-23.4203	858.9287	12.8739	3.6523
5	-6.0314	-1.7854	48	33.1847	-12.1480	3.8264	90.6846	-23.7525	853.9756	-12.1383	4.1240
6	-1.2970	-1.1493	62	52.8419	-1.9117	6.0681	89.6000	-23.4078	858.2532	-2.8974	6.7105
7	-2.9448	-0.2415	62	52.9889	-9.3049	7.1239	90.0130	-23.5793	861.1108	-9.9107	7.5948
8	-0.9201	-2.8255	62	58.1987	4.1177	10.4414	92.0710	-24.0837	861.5698	5.3930	10.4079
9	-3.4080	0.4814	62	50.6009	-6.9093	4.5554	91.4742	-23.7105	865.0813	-6.1767	4.8951
10	4.0846	-2.2687	22	61.8198	4.9589	10.9552	88.9313	-24.7934	861.5366	3.3768	10.2120
11	0.7483	-1.5340	62	58.4190	5.6352	9.8783	92.0048	-23.7012	861.1436	6.8538	10.2273
12	-2.5301	-0.1469	62	37.6420	-8.7850	-6.9518	89.5560	-24.8842	859.6978	-9.7992	-7.7859
13	0.7270	-0.9677	62	51.4246	-1.3907	4.7435	89.3668	-23.5701	860.5901	-2.5889	5.2235
14	-2.9830	-3.2396	61	66.3928	1.8109	3.5921	92.3784	-25.4312	862.2556	3.3500	2.2111
15	-2.1150	-1.5621	62	54.1285	-11.4861	8.6701	90.3269	-23.9164	859.7192	-11.8035	8.8038
16	2.2049	1.1854	11	24.2104	11.1109	5.9619	91.0943	-23.0555	860.7458	11.4976	6.9565
17	2.9958	-0.7328	34	66.1921	6.1140	0.3939	91.6507	-24.3923	860.8662	7.0035	0.0517
18	2.4297	3.1576	4	44.5363	6.9807	-13.6082	89.8549	-24.3349	861.3787	6.2344	-13.8929
19	-3.3653	-1.0284	62	54.8930	-13.3692	9.1466	90.9952	-23.6128	860.6841	-13.0745	9.5839
20	-3.9128	-1.1840	62	54.1545	-9.7256	8.6433	90.2544	-23.9218	859.0593	-10.1092	8.7716
21	-1.6775	0.4559	63	72.2339	-10.1298	5.2046	91.0281	-23.3271	862.2930	-9.8046	5.9276
22	-0.2799	0.2438	63	69.0653	-10.2278	2.0780	90.0866	-23.4529	861.8813	-10.7667	2.6753
23	2.1503	0.3158	63	74.6773	11.5874	7.2260	91.3126	-23.0883	855.8589	12.1748	8.1878
24	0.2541	-3.4050	30	36.5580	-1.4521	7.7499	89.8807	-24.7532	865.8564	-2.1725	7.0468
25	0.9745	-0.3407	62	52.4549	-5.2946	6.9108	89.1259	-24.1446	861.1101	-6.7073	6.8163
26	-7.3798	-2.5917	48	40.2416	-15.0280	-2.6314	92.0874	-25.8391	859.3882	-13.1559	-4.4203
27	-2.4388	0.1163	62	47.7419	-4.3549	1.2247	91.4927	-23.6165	864.7383	-3.6048	1.6584
28	-3.6476	0.3578	62	40.5629	-12.8382	-4.2557	90.1331	-24.5405	861.4810	-13.3303	-4.7461
29	1.7091	-3.0904	31	56.2486	10.7695	8.7281	90.5337	-24.0618	864.1223	10.6414	8.7164
30	1.1853	0.3037	63	72.6461	8.7145	5.8866	91.0998	-23.5469	864.2280	9.1048	6.3899
31	-4.2051	-1.0653	62	50.9551	-7.8245	4.9452	90.0524	-23.5350	857.5684	-8.3945	5.4404
32	-2.7962	-0.4745	62	52.9846	-10.4831	6.9914	91.7939	-23.4758	858.7844	-9.4559	7.5657
33	-3.0551	0.9547	16	57.8533	10.1933	-7.3865	91.5919	-24.3538	863.1582	11.0295	-7.6901
34	-1.6006	1.1009	13	35.1117	0.4743	1.2026	92.4028	-23.4583	859.3381	2.0602	1.7945
35	4.7258	-0.0771	24	55.7758	11.1098	-1.2982	91.2570	-24.8645	860.4521	11.6387	-2.1125
36	0.4597	0.2299	63	73.9388	-7.1001	7.4444	89.6702	-23.7411	863.6938	-8.0189	7.7535
37	-2.9914	-2.0940	62	55.2809	-2.0727	9.0152	89.7939	-23.8886	856.5193	-2.0775	9.1768
38	-2.4448	-1.4893	62	52.0077	-3.9382	5.7784	89.6958	-23.6797	856.8623	-4.8341	6.1489
39	-1.3264	-0.3184	62	45.6486	-8.0458	0.1921	90.8173	-24.1475	866.3892	-7.9151	0.0948
40	-1.1638	-0.5179	62	49.1859	-4.3690	3.5071	89.5246	-24.1784	860.8838	-5.4176	3.3788
41	-0.9489	-2.5110	62	53.5506	-9.9543	8.7515	89.9605	-24.6131	863.6226	-10.6030	8.1886
42	-6.3053	-1.5173	49	35.2784	-9.8805	-6.0404	92.3337	-25.2899	859.7654	-8.3799	-7.8801
43	0.9221	-2.3138	31	54.3117	-1.2547	10.9755	89.0879	-24.5248	862.2944	-2.6978	10.5008
44	-0.4201	-1.2752	62	54.7939	4.6830	7.2301	92.5871	-24.7088	862.6931	6.4209	6.5715
45	-3.5664	0.6185	63	71.8353	-10.9912	5.1088	90.7002	-23.7207	862.8230	-10.9672	5.4382
46	-0.6946	0.8651	13	24.4740	-7.6785	4.4598	89.4119	-23.1791	859.5066	-8.8388	5.3308
47	0.9248	-0.0388	63	77.3589	-5.7410	11.0740	89.7203	-23.8712	862.7368	-6.6132	11.2529
48	2.9910	0.3359	34	53.3332	12.8203	-12.6509	90.0629	-24.6653	859.9729	12.2649	-13.2660
49	2.6822	-3.7484	21	56.0928	8.8591	10.9048	91.1506	-25.3763	861.8340	9.2897	9.5787
50	-5.6179	-1.1423	39	77.1942	-13.2624	8.4891	91.9391	-24.0724	859.5762	-12.1073	8.4669

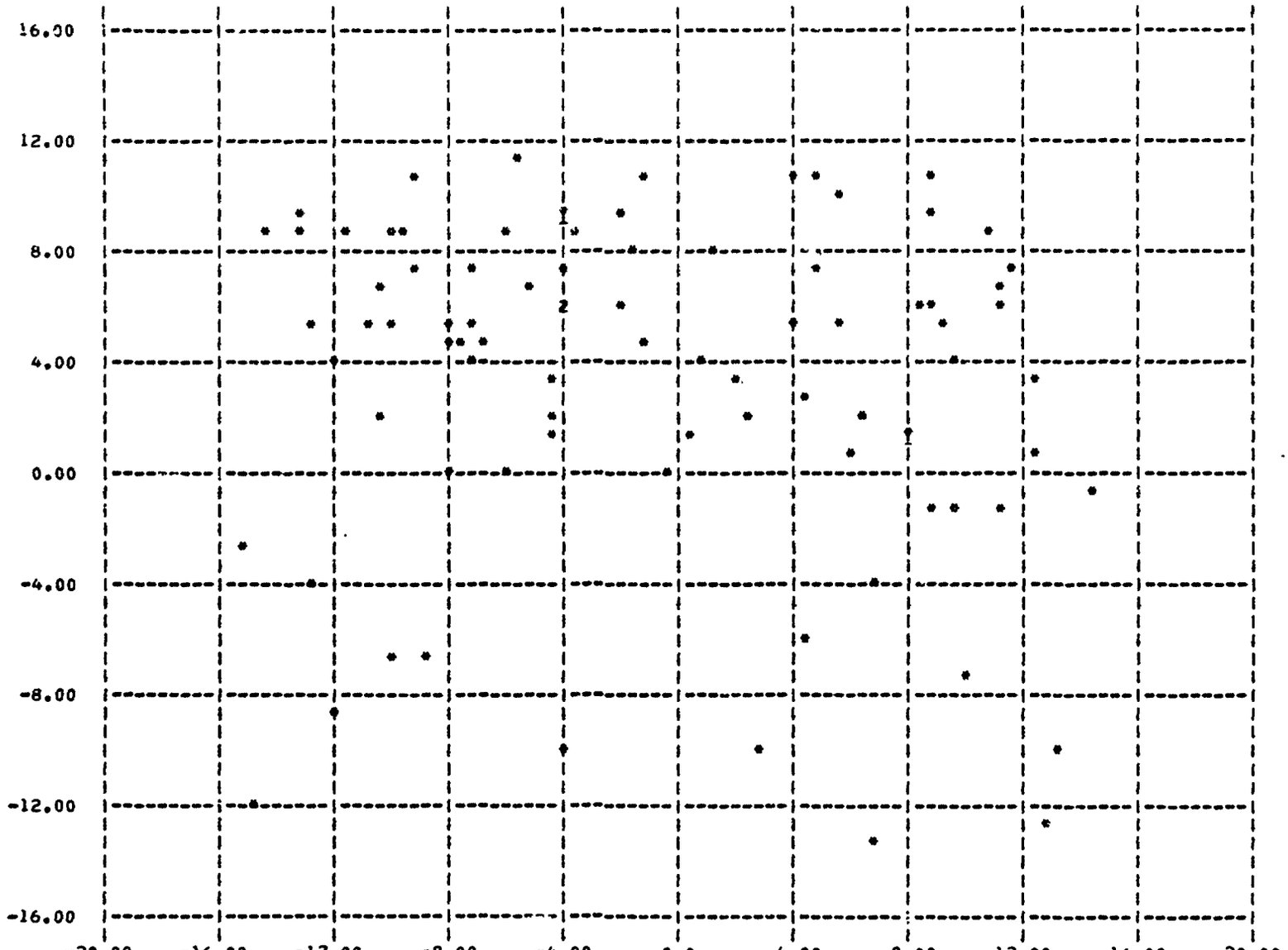
51	-2.1118	-0.8506	62	51.2760	6.5758	2.2706	92.3414	-23.9911	862.3237	8.0992	2.3297
52	1.2526	-0.2367	63	70.4203	9.4021	4.0159	89.9356	-23.8819	858.8428	8.7269	4.1841
53	-0.3630	-0.4749	62	55.9303	8.2239	6.0718	91.9854	-23.3253	860.1165	9.4281	6.7967
54	0.9029	1.0155	12	11.9464	6.6314	-4.1379	91.9120	-24.2354	861.9719	7.7603	-4.3231
55	5.3580	2.0012	34	55.7559	13.0595	-10.2627	89.6487	-24.6029	859.6482	12.1273	-10.8154
56	-1.9059	0.5511	63	72.0022	5.4442	5.5164	91.9340	-23.6760	863.6777	6.5981	5.8906
57	-0.1659	-2.7100	62	58.2569	8.9437	9.1637	91.1768	-23.9504	865.2510	9.4032	9.2634
58	-3.1756	1.0437	63	58.3201	-11.9949	-8.3902	90.4592	-23.9041	860.3914	-12.1913	-8.2442
59	2.2221	-1.3081	33	33.4075	3.8449	5.2122	89.3309	-23.5931	860.5376	2.6140	5.6692
60	-2.3532	-3.6465	MISSED		-3.6154	8.6239	91.8600	-24.7362	865.6636	-2.5383	7.9379
61	0.8710	-0.8146	62	50.0458	2.4620	2.2466	90.7522	-23.5704	863.4036	2.5336	2.7263
62	-0.9895	-0.3953	62	50.8034	4.2579	2.5646	91.5188	-23.7940	866.3096	5.0309	2.8207
63	-5.0837	-0.7658	62	54.7313	-6.1069	8.4282	92.3434	-23.6160	862.1077	-4.5774	8.8624
64	-4.5804	-3.0114	61	53.5666	-9.0096	10.9555	90.3143	-23.9673	855.5088	-9.3383	11.0384
65	2.5473	-0.9476	33	39.3658	9.1655	5.5719	90.8918	-24.1705	863.8413	9.3642	5.4516
66	2.2159	-0.2813	34	66.0554	-0.3552	-0.0314	89.1620	-23.9249	864.1941	-1.7373	0.0939
67	-3.3767	-0.1775	62	54.0603	-4.0946	7.4628	89.4577	-23.2470	856.5178	-5.2142	8.2659
68	2.8337	-1.2116	33	32.0016	0.8087	4.1633	90.0407	-23.6281	864.0278	0.2285	4.5853
69	6.4437	-1.0451	22	53.7390	14.4334	-0.9712	89.6402	-24.1822	858.8821	13.4903	-1.1032
70	-2.4044	-1.1750	62	53.3346	-14.5024	8.4934	90.3356	-24.5362	862.5222	-14.8102	8.0077
71	-0.7580	-0.7586	62	48.3079	-4.4206	1.9941	90.4466	-23.6578	861.8875	-4.6289	2.3864
72	0.1345	-4.3373	MISSED		1.3492	8.1777	91.9105	-25.3315	863.4089	2.4668	6.8963
73	3.6915	-1.1869	24	74.1846	-7.1173	5.6205	88.9798	-23.5854	859.9827	-8.6700	6.0853
74	4.3546	-0.9137	22	70.9347	-3.8919	9.4094	88.5166	-23.8873	861.0305	-5.8646	9.5722
75	1.8238	0.5438	63	66.7873	-5.9911	0.2662	88.6993	-23.7146	857.0576	-7.7991	0.6024
76	-2.2910	-1.3567	62	47.8932	8.7777	-1.5005	92.1184	-24.5817	864.7461	10.0912	-2.0321
77	-1.3387	0.8627	13	27.4776	-4.0799	5.8760	90.9756	-23.1855	862.8379	-3.8027	6.7406
78	1.3391	1.6059	11	19.8566	12.2954	0.8642	91.4445	-23.4303	859.2104	13.0023	1.4841
79	-1.4676	0.2717	63	54.0256	2.6760	-10.2641	91.3929	-25.7578	860.2290	3.3234	-11.9717
80	4.3697	1.6018	34	65.0666	9.6063	-1.3221	91.3581	-24.0213	857.5386	10.2312	-1.2932
81	0.1641	-1.5502	62	41.1076	4.4501	-6.0867	90.8186	-25.1788	866.2681	4.5809	-7.2153
82	-2.3176	0.5646	63	71.0717	-7.3240	4.0482	89.6006	-23.2349	858.1599	-8.3103	4.8634
83	1.2388	-1.5420	32	66.4232	8.1090	1.0505	90.2692	-24.8595	865.4321	7.7417	0.2411
84	0.8677	1.0258	12	5.1884	-4.0797	-9.7658	89.7134	-24.3657	862.2581	-4.9548	-10.0813
85	-3.6313	-0.5673	62	51.4154	-7.9083	5.0055	91.0375	-23.2012	862.5479	-7.5742	5.8544

RESULTS FOR 2.000 KM DESIGNATION RANGE

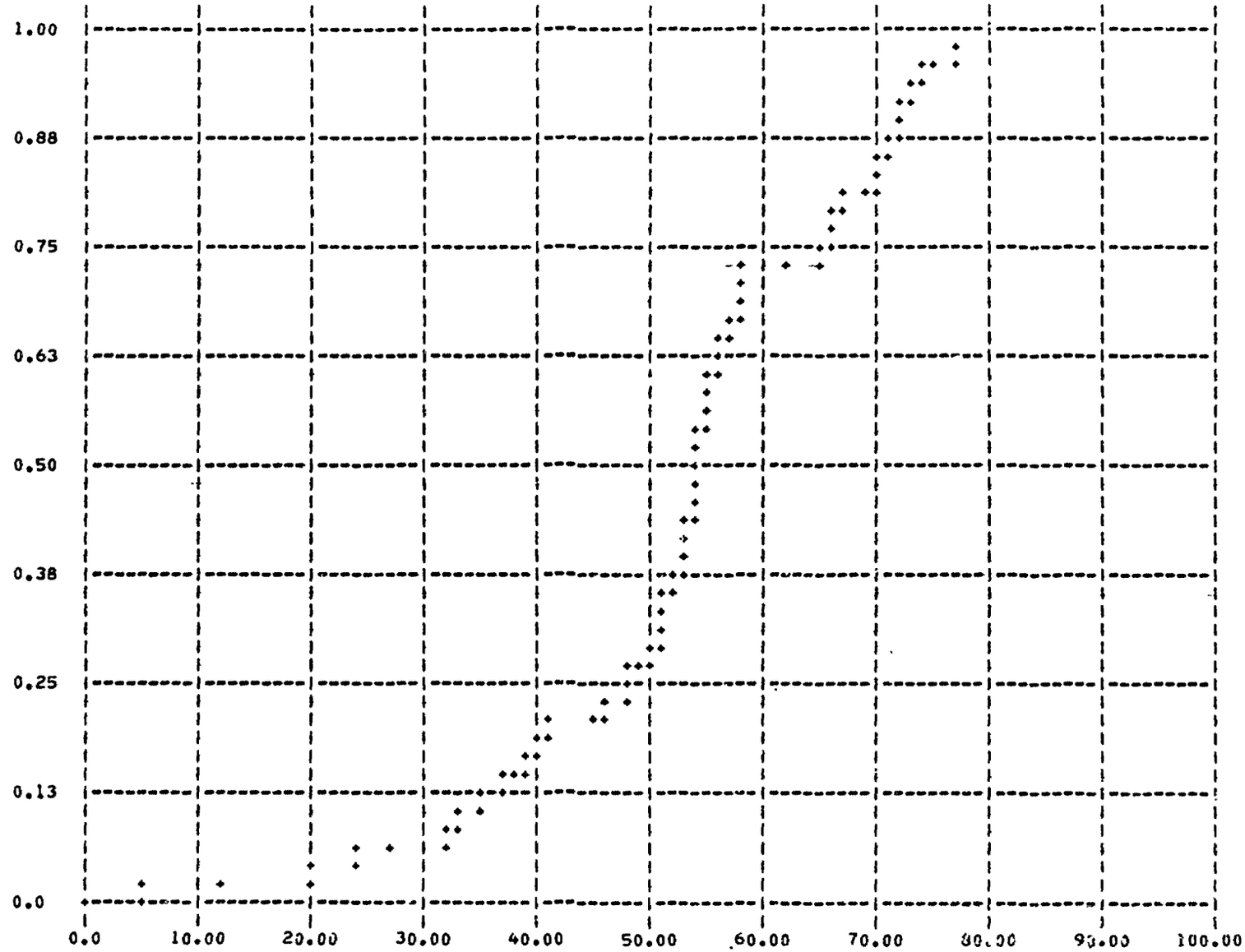
TARGET HEADING -115.00 DEGREES IN ZOT COORDINATE SYSTEM
DESIGNATION POINT IN FACET COORDINATES -209.40 57.60 18.00



IMPACT-PLANE SCATTER PLOT OF IMPACTS AND TARGET CORNERS RELATIVE TO DESIGNATION POINT



FREQUENCY PLOT OF TERMINAL ANGLES OF ATTACK



CUMULATIVE SAMPLE DISTRIBUTION OF IMPACT OBLIQUITIES

PERCENTILES:																			
RANK	.05	.10	.15	.20	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70	.75	.80	.85	.90	.95
DEVIATE (D	24.3	33.3	37.2	41.0	47.9	50.6	51.4	52.9	53.5	54.0	54.4	55.5	56.2	58.2	65.1	66.5	70.6	72.0	74.1

RESULTS FOR 2.000 KM DESIGNATION RANGE

OUTCOMES:	NUMBER	FRACTION
FAILED TO ACQUIRE	0	0.0
ACQUIRED BUT MISSED	2	0.02353
ACQUIRED AND HIT	83	0.97647

APPROXIMATE PROBABILITY OF TARGET BEING IN ACQUISITION FOOTPRINT: 1.00000

	MISS DIST (FEET)	YAW ERROR (FEET)	PITCH ERROR (FEET)	PHI.V (DEGREES)	THETA.V (DEGREES)	SPEED (FPS)	ALPHA.Y (DEGREES)	ALPHA.P (DEGREES)
MEANS	2.8649	-0.5615	-0.6539	90.6740	-24.0502	861.1609	-0.8821	3.2146
STD DEVS	1.5920	2.8514	1.3990	1.0654	0.6513	3.3015	8.4971	6.1147

*NOTE: PHI.V MEASURED CCW FROM +Z-AXIS IN ZOT SYSTEM.

YAW-PITCH CORRELATION 0.1496
SQUARE TARGET HIT PROBABILITIES: APPROX 0.81176, DERIVED 0.79155 GIVEN ACQUISITION.
EQUIVALENT CIRCULAR-NORMAL STD DEV 2.34795 FT
VEHICULAR TARGET HIT PROBABILITY: APPROX 0.97647 GIVEN ACQUISITION.
ANGLE-OF-ATTACK CORRELATIONS: ALPHA.Y-ALPHA.P -0.1288 ALPHA.Y-ERR.Y 0.6983 ALPHA.P-ERR.P -0.5442
OBLIQUITY MEAN 53.1202, STD. DEV. 14.7452 DEG

SORTED MISS DISTANCES (FT)

0.2578	0.3713	0.5140	0.5978	0.9256	0.9563	1.0323	1.0655	1.0724	1.1094
1.1926	1.2104	1.2236	1.2738	1.2769	1.3426	1.3436	1.3588	1.3641	1.3651
1.4925	1.5589	1.5926	1.6748	1.7067	1.7329	1.7384	1.9032	1.9426	1.9779
1.9840	2.1734	2.2336	2.2767	2.3853	2.4284	2.4416	2.4908	2.5033	2.5344
2.6293	2.6625	2.6761	2.6843	2.7151	2.7178	2.8362	2.8627	2.9547	2.9716
3.0098	3.0819	3.0841	3.2656	3.3427	3.3814	3.4145	3.4419	3.5189	3.5315
3.6196	3.6515	3.6651	3.6754	3.8776	3.9842	4.0880	4.3379	4.3394	4.3399
4.4038	4.4495	4.6092	4.6540	4.6724	4.7264	4.8131	5.1411	5.4817	5.7195
5.7329	6.2901	6.4853	6.5279	7.8217					

SORTED YAW ERRORS (FT)

-7.3798	-6.3053	-6.0314	-5.6179	-5.0837	-4.7378	-4.5804	-4.2051	-3.9128	-3.6476
-3.6313	-3.5664	-3.4080	-3.3767	-3.3653	-3.1756	-2.9914	-2.9830	-2.9448	-2.7962
-2.5301	-2.4448	-2.4388	-2.4044	-2.3605	-2.3532	-2.3176	-2.2910	-2.1150	-2.1118
-1.9059	-1.6775	-1.6006	-1.4676	-1.3387	-1.3264	-1.2970	-1.1638	-0.9895	-0.9489
-0.9201	-0.7580	-0.6946	-0.4201	-0.3630	-0.2799	-0.1835	-0.1659	-0.0551	0.1345
0.1641	0.2541	0.4597	0.7270	0.7483	0.8677	0.8710	0.9029	0.9221	0.9248
0.9745	1.1853	1.2388	1.2526	1.3391	1.3622	1.7091	1.8238	2.1503	2.2049
2.2159	2.4297	2.5473	2.6822	2.8337	2.9910	2.9921	2.9958	3.6915	4.0846
4.3546	4.3697	4.7258	5.3580	6.4437					

SORTED PITCH ERRORS (FT)

-4.3373	-3.7484	-3.6465	-3.4050	-3.2396	-3.0904	-3.0114	-2.8255	-2.7100	-2.5917
-2.5110	-2.3138	-2.2687	-2.0940	-1.7854	-1.5621	-1.5502	-1.5420	-1.5340	-1.5173
-1.4893	-1.3567	-1.3081	-1.2752	-1.2116	-1.1869	-1.1840	-1.1750	-1.1493	-1.1423
-1.0653	-1.0451	-1.0284	-0.9677	-0.9476	-0.9137	-0.8506	-0.8146	-0.7658	-0.7586
-0.7328	-0.5673	-0.5179	-0.4749	-0.4745	-0.3953	-0.3407	-0.3184	-0.2813	-0.2415
-0.2367	-0.1811	-0.1775	-0.1469	-0.0897	-0.0771	-0.0388	0.1163	0.2299	0.2438
0.2717	0.3037	0.3158	0.3359	0.3578	0.4559	0.4814	0.5438	0.5511	0.5646
0.5705	0.6185	0.8482	0.8627	0.8651	0.9547	1.0059	1.0155	1.0258	1.0437
1.1009	1.1854	1.6018	2.0012	3.1576					

SORTED OBLIQUITIES (DEG):

5.1884	11.9464	19.8566	24.2104	24.4740	27.4776	32.0016	33.1847	33.4075	35.1117

35.2784	36.5580	37.6420	39.3658	40.2416	40.5629	41.1076	44.5363	45.6486	47.7419
47.8932	48.3079	49.1859	50.0458	50.6009	50.8034	50.9551	51.2760	51.4154	51.4246
52.0077	52.4549	52.8419	52.9846	52.9889	53.3332	53.3346	53.5506	53.5666	53.7390
53.9368	54.0256	54.0603	54.1285	54.1545	54.3117	54.7313	54.7939	54.8930	55.2809
55.7559	55.7758	55.9303	56.0928	56.2486	56.9757	57.8533	58.1987	58.2569	58.3201
58.4190	61.8198	65.0666	66.0554	66.1921	66.3928	66.4232	66.7873	69.0653	70.2258
70.4203	70.9347	71.0717	71.8353	72.0022	72.0759	72.2339	72.6461	73.9388	74.1846
74.6773	77.1942	77.3589							

NUMBER OF IMPACTS BY FACET:

FACET NO.	NO. OF IMPACTS
62	34
63	15
34	5
13	3
22	3
33	3
11	2
12	2
24	2
31	2
48	2
61	2
4	1
16	1
21	1
30	1
32	1
39	1
49	1
52	1

RESULTS FOR 4.000 KM DE. TION RANGE

TARGET HEADING -115.00 DEGREES IN ZOT COORDINATE SYSTEM
DESIGNATION POINT IN FACET COORDINATES -209.40 57.60 18.00

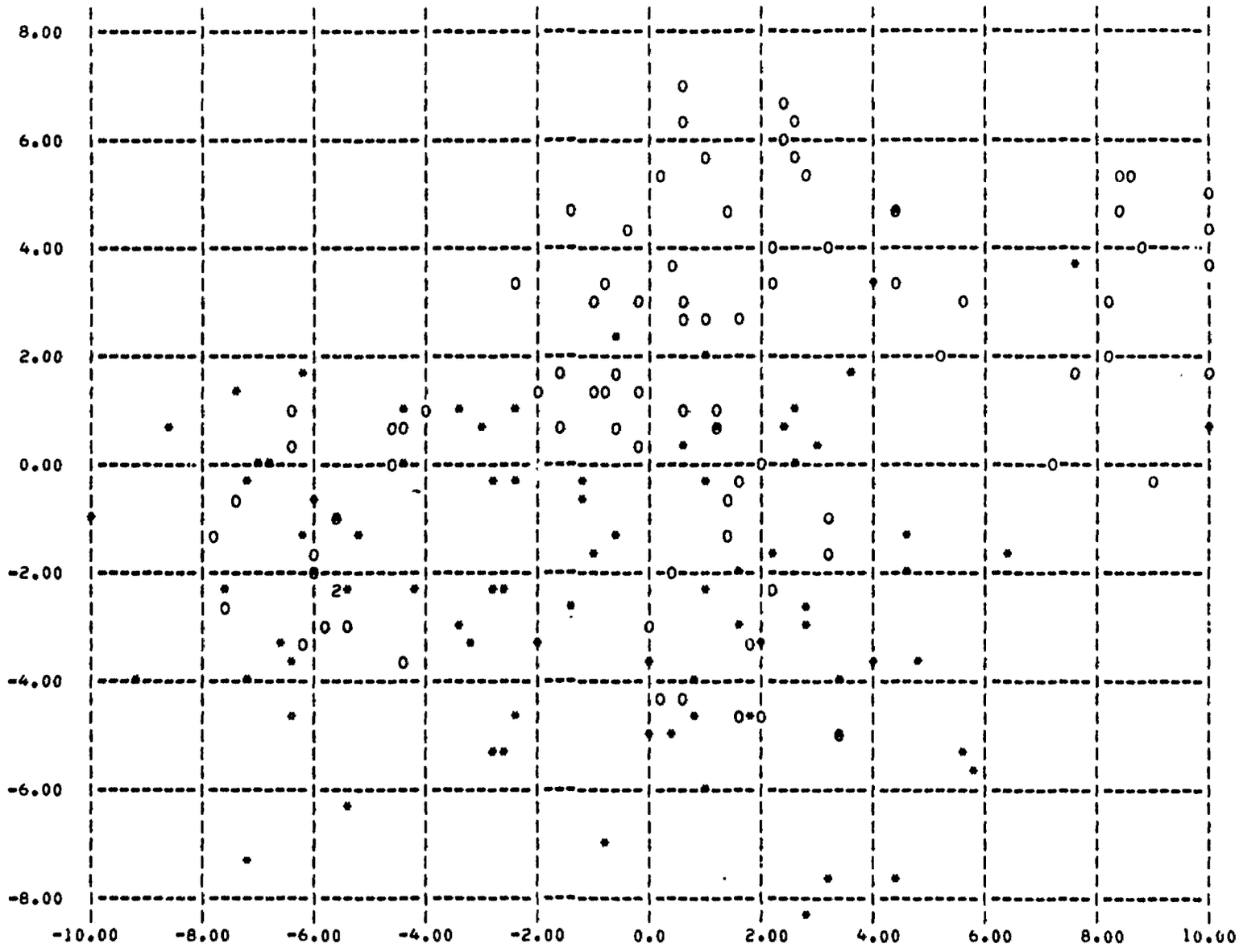
OUTCOMES OF INDIVIDUAL REPLICATIONS:

REP	YAW	PITCH	FACET NO.	OBLIQUITY (DEG)	ALPHA.Y	ALPHA.P	PHI.V	THETA.V	AIRSPEED (FPS)	BETA.Y	BETA.P
1	-4.3499	1.1065	52	76.5480	-12.9850	9.4332	90.6252	-23.5029	852.0544	-13.0667	10.1948
2	-0.5615	2.2487	14	24.4612	-10.0884	-11.2320	90.8482	-25.4416	850.0278	-9.9676	-12.4091
3	-5.1966	-1.3101	62	52.5661	-11.3974	6.0171	89.1869	-22.8209	847.0437	-12.8053	7.4607
4	3.3665	-3.9826	22	52.1613	12.7855	10.7243	91.0846	-23.5649	849.1023	13.1248	11.4239
5	-0.0961	-4.9065	MISSED		-10.9802	4.3609	90.5850	-24.0483	853.9529	-11.0984	4.5771
6	-7.2299	-7.2757	MISSED		-4.4071	11.2121	90.3631	-24.3512	854.9634	-4.7271	11.1254
7	-6.7020	0.0566	MISSED		-7.5906	7.6822	90.4803	-23.3969	854.6306	-7.8054	8.5499
8	0.9302	-5.8896	MISSED		-5.8241	12.5592	91.2577	-24.5523	857.9700	-5.3298	12.2715
9	-6.1828	1.5420	MISSED		-9.5787	4.7933	92.3080	-23.5764	859.4387	-8.1181	5.4814
10	0.8325	-4.7384	MISSED		-9.3765	14.4519	89.0747	-25.8482	852.8303	-10.8522	12.8682
11	3.9643	-3.5310	22	58.8355	5.4505	10.0066	91.7569	-23.9695	857.1001	6.4031	10.3016
12	-7.1647	-0.3541	MISSED		-5.9366	-10.5919	89.9605	-25.4710	849.9182	-6.6172	-11.7984
13	-1.9617	-3.2902	61	60.8004	-5.6687	4.2157	89.4299	-24.0152	855.0344	-6.8419	4.4649
14	-2.6791	-5.4520	MISSED		4.6236	2.8859	92.3743	-26.3582	853.1724	6.1109	0.7922
15	-3.2375	-3.2637	61	56.5466	-11.4106	7.4119	90.6379	-24.2789	851.3213	-11.4803	7.3976
16	4.6107	-1.3974	22	53.2650	12.0553	7.7723	90.9275	-23.2963	856.5745	12.2510	8.7406
17	6.3073	-1.5466	22	60.7877	6.6003	-3.3486	91.1103	-24.9430	855.2432	6.9594	-4.02[illegible]
18	4.3236	4.5498	3	43.6120	8.6675	-14.5826	89.0598	-24.2246	855.8120	7.1586	-14.5427
19	-5.4935	-2.4389	61	54.1783	-14.9049	8.4405	91.2907	-23.7183	851.8042	-14.3772	8.9868
20	-7.6667	-2.4759	48	30.9136	-8.2004	9.6094	90.8743	-24.1076	851.2344	-8.0544	9.7662
21	-3.4399	-3.0200	61	55.6797	-13.0677	7.8117	91.5355	-24.0333	859.1167	-12.3177	8.0429
22	-1.0763	-1.6592	62	53.4163	-9.5102	7.4826	90.0482	-23.5079	856.3535	-10.1211	8.2392
23	3.3029	-4.9244	22	53.2607	11.7931	11.4797	90.8913	-23.7126	850.5510	11.9552	12.0316
24	0.7798	-4.1044	30	38.1624	-1.2946	5.4620	89.2931	-24.8960	860.3152	-2.5830	4.8305
25	-1.2774	-0.6745	62	54.1096	-2.6463	8.4885	89.3511	-24.4044	855.9529	-3.8877	8.3486
26	-7.1941	-3.8801	MISSED		-12.0701	-2.7180	91.8269	-26.5841	853.8376	-11.0752	-5.0377
27	-4.3102	-0.0835	62	47.0766	-6.1049	0.7568	92.3336	-23.6730	859.7773	-4.6219	1.3483
28	-8.5429	0.5317	MISSED		-12.8110	-8.7330	90.6328	-25.0029	852.5823	-12.8849	-9.4714
29	3.1669	-7.5043	MISSED		13.9974	9.4692	90.0097	-24.0562	858.5674	13.3539	9.6775
30	2.3886	0.6522	63	74.0639	11.0085	6.8088	91.1937	-23.2280	858.3950	11.4489	7.8453
31	-9.1558	-4.0535	MISSED		-6.8952	7.3791	90.7838	-23.8830	850.5022	-6.8317	7.7605
32	2.1854	-1.7602	32	72.2906	-2.3855	5.8703	90.6735	-23.6016	852.5415	-2.4229	6.5332
33	0.9772	1.8467	12	15.4494	9.8876	-2.1203	91.7768	-23.5247	858.7458	10.8617	-1.3805
34	2.5170	0.9183	63	68.6942	6.1211	1.9928	92.1674	-23.5119	854.5815	7.4535	2.7453
35	10.2707	0.7245	MISSED		10.2819	-6.3925	90.5496	-25.2263	848.5322	10.1329	-7.3543
36	0.5301	0.3573	63	75.0137	-5.9537	8.5253	89.0451	-23.7165	856.6389	-7.4820	9.0733
37	-6.3944	-4.5330	MISSED		-2.8663	9.9186	90.2072	-24.2140	849.3301	-3.3288	9.9692
38	-6.3636	-3.5338	MISSED		-3.8523	5.8905	90.2820	-23.8176	849.6841	-4.2477	6.3374
39	-2.3227	-0.1786	62	40.1813	-12.6655	-4.8130	90.9466	-24.3799	861.3381	-12.4540	-4.9283
40	-5.5324	-1.0400	40	69.7916	-3.0187	2.9873	90.0034	-24.4563	853.3867	-3.6658	2.7956
41	-2.7138	-5.2064	MISSED		-8.1604	11.3654	90.1143	-25.4570	856.6333	-8.7022	10.1729
42	-4.1033	-2.2530	61	75.7565	3.1372	-6.6541	91.9583	-24.9331	848.0491	4.2652	-7.3227
43	-2.4209	-4.7676	MISSED		-5.5068	14.3891	89.3376	-25.3156	856.8145	-6.7513	13.3380
44	2.7698	-2.5312	22	59.1083	4.8698	8.9005	92.4552	-25.5377	857.5996	6.4405	7.6273
45	-7.3732	1.2730	MISSED		-12.0429	5.5574	91.1447	-23.5990	854.2695	-11.6485	6.2230
46	-2.4655	0.9025	63	72.3250	-3.0883	5.3681	89.4928	-23.1093	854.9785	-4.2118	6.5233
47	1.0253	-0.2405	63	80.4713	-4.5863	14.4222	89.4051	-24.0684	854.4614	-5.7817	14.6183
48	4.3195	-7.5027	MISSED		13.1380	10.2138	89.4817	-25.4573	856.9192	12.0250	9.0210
49	5.5012	-5.4682	MISSED		9.3310	12.0764	90.4063	-26.1858	850.9768	9.0550	10.1551
50	-2.6977	-2.4732	62	57.9208	0.1184	11.2360	92.7958	-24.3456	857.2705	2.0148	11.1549

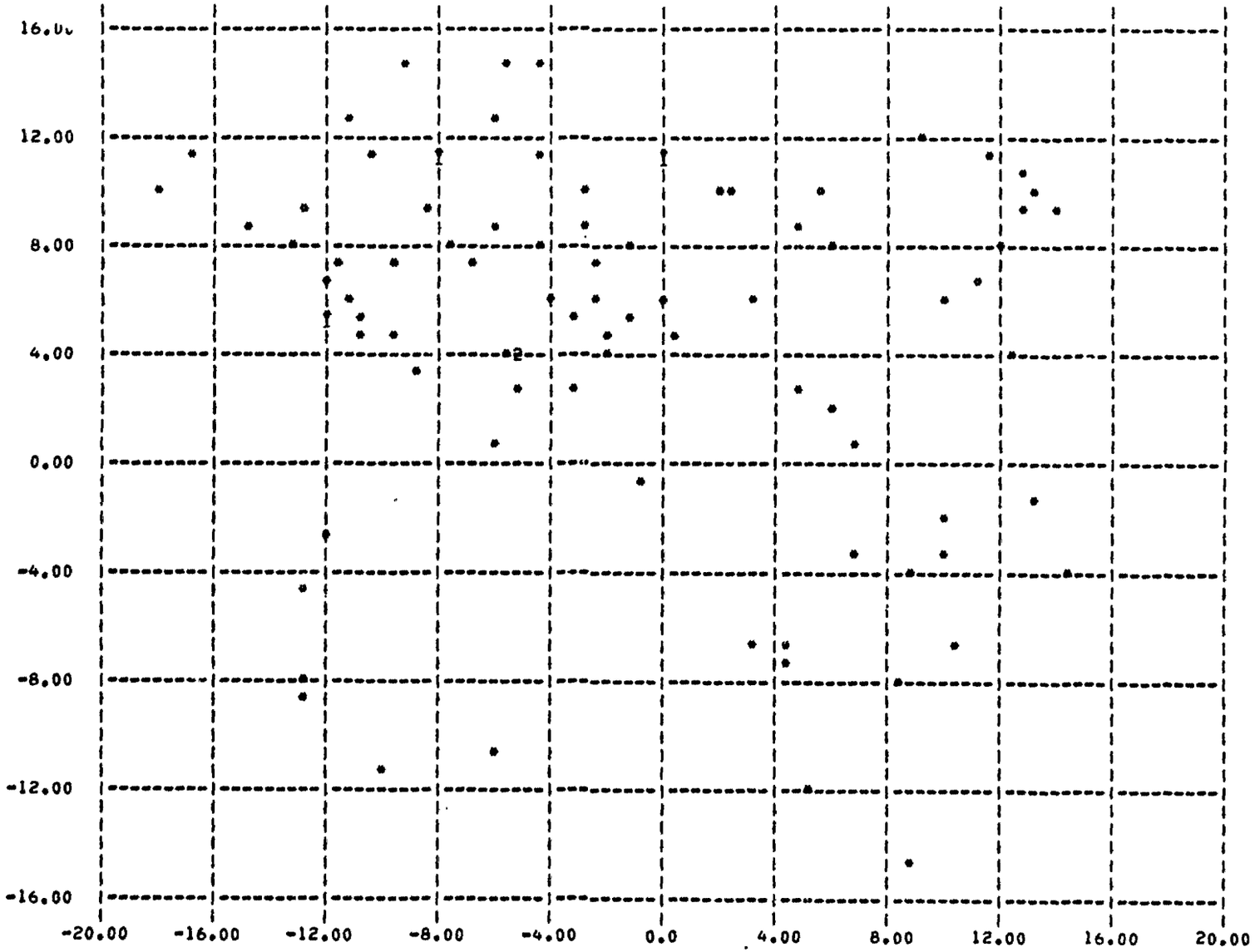
51	-0.5401	-1.2101	62	46.3004	-0.6036	-0.4801	91.7837	-24.1769	856.9158	0.3720	-0.3925
52	-5.9669	-0.5546	50	70.6923	-8.9400	3.5685	91.1530	-23.1519	849.6936	-8.5367	4.6811
53	1.8105	-4.6066	29	78.9535	-2.2461	7.3570	91.4389	-24.3729	860.4590	-1.5861	7.2487
54	3.6108	1.6935	11	25.0005	4.2449	-6.6110	91.6199	-24.3015	855.9219	5.0702	-6.6480
55	4.0877	3.2470	11	16.4433	14.5669	-3.7690	90.8741	-23.0517	851.6970	14.7139	-2.5562
56	-3.4804	0.9726	63	74.5724	6.0993	7.8046	92.7009	-23.4627	855.4028	7.9216	8.6064
57	0.4656	-5.0843	MISSED		12.6820	9.3232	91.3935	-24.3420	861.2793	13.3008	9.2457
58	-6.9024	0.1561	MISSED		-12.7398	-7.8809	90.8484	-23.9481	852.4382	-12.6173	-7.5644
59	-0.0137	-3.5160	61	62.4030	0.2468	4.9086	90.4620	-23.8027	854.9519	0.0159	5.3704
60	-0.8566	-7.1223	MISSED		-17.8849	9.9173	90.6581	-25.7452	860.1045	-17.9356	8.4366
61	1.5259	-3.1286	31	51.7147	3.0859	6.1104	90.7367	-23.6833	856.2847	3.1064	6.6916
62	-1.2987	-0.2437	62	50.0405	6.7431	0.7147	92.2287	-23.7679	862.9839	8.1291	1.2113
63	-6.2870	-1.2177	49	53.0865	-1.0231	7.9921	93.2583	-23.6611	855.2539	1.3070	8.5954
64	-5.4402	-6.4659	MISSED		-11.3439	12.6733	90.8780	-24.4940	850.3640	-11.1943	12.4438
65	4.5860	-2.0056	22	56.1514	9.8003	6.2489	90.5806	-24.5459	857.1416	9.6786	5.9675
66	2.6949	-0.0481	34	62.4616	8.8667	-3.7600	89.1043	-23.9990	859.3513	7.3959	-3.4945
67	-10.2040	-1.0995	MISSED		0.1908	6.0774	90.0830	-22.4067	846.0796	-0.3929	7.9352
68	5.7905	-5.7264	MISSED		1.8785	9.7683	89.3324	-24.1719	860.1340	0.6177	9.8609
69	2.7211	-2.8633	22	69.1637	-1.9198	3.8708	89.2490	-23.9887	858.6318	-3.2585	4.1466
70	-5.5156	-2.4358	61	52.6210	-16.6370	11.0112	90.7725	-25.2993	854.2039	-16.5844	9.9764
71	-1.4182	-2.7308	62	49.9788	-5.0033	3.9335	90.2763	-23.8148	850.9863	-5.4041	4.3833
72	2.8781	-8.1892	MISSED		2.4320	9.8935	91.8570	-26.5753	851.7131	3.4540	7.5826
73	4.7007	-3.7117	22	69.3258	-2.0914	4.7353	89.0947	-23.9451	854.1248	-3.5717	5.0547
74	1.5209	-1.8353	32	78.1494	-10.2167	11.5881	88.6889	-23.9594	857.0618	-12.0676	11.8932
75	-5.6450	-2.4058	61	57.6423	-10.7449	5.1657	89.3774	-23.3368	848.3909	-11.9725	6.0934
76	-2.7947	-2.1824	62	40.1863	4.4563	-7.4614	92.4173	-25.3112	857.9834	5.9957	-8.5081
77	-2.7499	-0.2275	62	50.4003	-5.1661	3.9495	91.2792	-23.5051	859.4795	-4.6481	4.7089
78	3.0655	0.3798	34	71.4925	12.2580	4.2043	91.3193	-23.3287	849.3662	12.8135	5.1401
79	-3.0238	0.6622	63	52.8569	5.1318	-11.7752	92.0015	-25.5414	855.6553	6.2932	-13.0521
80	7.5401	3.8027	34	63.4282	10.1575	-3.5394	90.7395	-23.4470	847.9370	10.1806	-2.7219
81	1.0664	-2.3230	31	38.0708	8.2091	-8.0446	90.8547	-26.1821	856.9043	8.3350	-9.9623
82	-6.0651	-1.9699	48	34.1570	-4.2691	7.6769	89.9441	-23.8760	854.5210	-4.9734	8.0654
83	2.0954	-3.2426	21	55.2670	13.1415	-1.4344	89.9113	-25.8800	854.9138	12.4190	-3.0498
84	1.1533	0.5051	63	69.9241	-5.2672	2.6922	89.0390	-22.9445	853.9849	-6.8100	4.0121
85	-6.6416	-3.2675	MISSED		-11.8625	6.9038	91.4162	-23.5618	858.8962	-11.2192	7.6065

RESULTS FOR 4.000 KM DESIGNATION RANGE

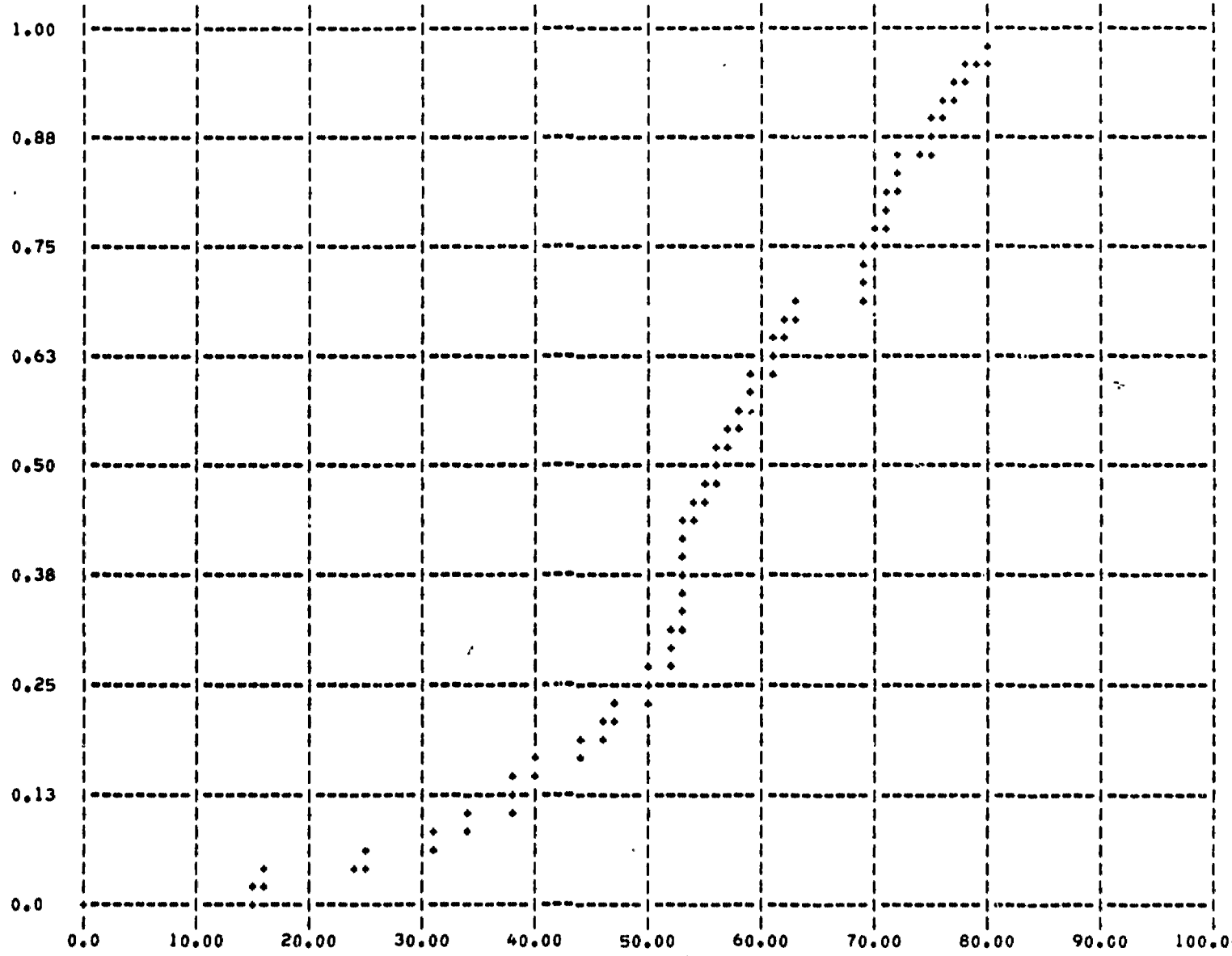
TARGET HEADING -115.00 DEGREES IN ZOT COORDINATE SYSTEM
DESIGNATION POINT IN FACET COORDINATES -209.40 57.60 18.00



IMPACT-PLANE SCATTER PLOT OF IMPACTS AND TARGET CORNERS RELATIVE TO DESIGNATION POINT



FREQUENCY PLOT OF TERMINAL ANGLES OF ATTACK



CUMULATIVE SAMPLE DISTRIBUTION OF IMPACT OBLIQUITIES

PERCENTILES:																			
RANK	.05	.10	.15	.20	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70	.75	.80	.85	.90	.95
DEVIATE (D	23.7	33.5	39.6	45.2	50.0	51.9	52.7	53.3	54.1	55.7	57.5	59.1	61.9	66.6	69.6	71.0	72.8	75.2	78.2

RESULTS FOR 4.000 KM DESIGNATION RANGE

OUTCOMES:	NUMBER	FRACTION
FAILED TO ACQUIRE	0	0.0
ACQUIRED BUT MISSED	28	0.32941
ACQUIRED AND HIT	57	0.67059

APPROXIMATE PROBABILITY OF TARGET BEING IN ACQUISITION FOOTPRINT: 1.00000

	MISS DIST	YAW ERROR (FEET)	PITCH ERROR	PHI.V (DEGREES)	THETA.V	SPEED (FPS)	ALPHA.Y (DEGREES)	ALPHA.P
MEANS	5.1703	-1.1220	-2.0533	90.7143	-24.2645	854.6904	-1.3738	4.3244
STD DEVS	2.3706	4.4402	2.7229	1.0713	0.9284	4.2171	8.7459	6.8323

*NOTE: PHI.V MEASURED CCW FROM +Z-AXIS IN ZOT SYSTEM.

YAW-PITCH CORRELATION -0.0005
SQUARE TARGET HIT PROBABILITIES: APPROX 0.38824, DERIVED 0.42063 GIVEN ACQUISITION.
EQUIVALENT CIRCULAR-NORMAL STD DEV 4.02486 FT
VEHICULAR TARGET HIT PROBABILITY: APPROX 0.67059 GIVEN ACQUISITION.
ANGLE-OF-ATTACK CORRELATIONS: ALPHA.Y-ALPHA.P -0.1688 ALPHA.Y-ERR.Y 0.6645 ALPHA.P-ERR.P -0.5839
OBLIQUITY MEAN 55.9285, STD. DEV. 15.5255 DEG

SORTED MISS DISTANCES (FT)

0.6393	1.0531	1.2590	1.3214	1.3252	1.4445	1.9777	2.0893	2.3178	2.3296
2.3836	2.4760	2.5561	2.6255	2.6793	2.6953	2.7592	2.8061	3.0771	3.0889
3.0955	3.4809	3.5161	3.5459	3.6138	3.6598	3.7522	3.8306	3.8607	3.9500
3.9882	4.1778	4.3110	4.4885	4.5775	4.5971	4.6811	4.8110	4.8178	4.9075
4.9496	5.0053	5.1056	5.2149	5.2204	5.3088	5.3470	5.3592	5.6293	5.8712
5.9294	5.9626	5.9894	5.9926	6.0105	6.0295	6.0747	6.1363	6.2765	6.3722
6.3770	6.4039	6.4941	6.7023	6.9042	7.1735	7.1736	7.2789	7.4018	7.4826
7.7565	7.8382	8.0566	8.1438	8.1452	8.1738	8.4448	8.4501	8.5594	8.6573
8.6802	10.0129	10.2571	10.2631	10.2962					

SORTED YAW ERRORS (FT)

-10.2040	-9.1558	-8.5429	-7.6667	-7.3732	-7.2299	-7.1941	-7.1647	-6.9024	-6.7020
-6.6416	-6.3944	-6.3636	-6.2870	-6.1828	-6.0651	-5.9669	-5.6450	-5.5324	-5.5156
-5.4935	-5.4402	-5.1966	-4.3499	-4.3102	-4.1033	-3.4804	-3.4399	-3.2375	-3.0238
-2.7947	-2.7499	-2.7138	-2.6977	-2.6791	-2.4655	-2.4209	-2.3227	-1.9617	-1.4182
-1.2987	-1.2774	-1.0763	-0.8566	-0.5615	-0.5401	-0.0961	-0.0137	0.4656	0.5301
0.7798	0.8325	0.9302	0.9772	1.0253	1.0664	1.1533	1.5209	1.5259	1.8105
2.0954	2.1854	2.3886	2.5170	2.6949	2.7211	2.7698	2.8781	3.0655	3.1669
3.3029	3.3665	3.6108	3.9643	4.0877	4.3195	4.3236	4.5860	4.6107	4.7007
5.5012	5.7905	6.3073	7.5401	10.2707					

SORTED PITCH ERRORS (FT)

-8.1892	-7.5043	-7.5027	-7.2757	-7.1223	-6.4659	-5.8896	-5.7264	-5.4682	-5.4520
-5.2064	-5.0843	-4.9244	-4.9065	-4.7676	-4.7384	-4.6066	-4.5330	-4.1044	-4.0535
-3.9826	-3.8801	-3.7117	-3.5338	-3.5310	-3.5160	-3.2902	-3.2675	-3.2637	-3.2426
-3.1286	-3.0200	-2.8633	-2.7308	-2.5312	-2.4759	-2.4732	-2.4389	-2.4358	-2.4058
-2.3230	-2.2530	-2.1824	-2.0056	-1.9699	-1.8353	-1.7602	-1.6592	-1.5466	-1.3974
-1.3101	-1.2177	-1.2101	-1.0995	-1.0400	-0.6745	-0.5546	-0.3541	-0.2437	-0.2405
-0.2275	-0.1786	-0.0835	-0.0481	0.0566	0.1561	0.3573	0.3798	0.5051	0.5317
0.6522	0.6622	0.7245	0.9025	0.9183	0.9726	1.1065	1.2750	1.5420	1.6935
1.8467	2.2487	3.2470	3.8027	4.5498					

SORTED OBLIQUITIES (DEG):

15.4494	16.4433	24.4612	25.0005	30.9136	34.1570	38.0708	38.1624	40.1813	40.1863

43.6120	46.3004	47.0766	49.9788	50.0405	50.4003	51.7147	52.1613	52.5661	52.6210
52.8569	53.0865	53.2607	53.2650	53.4163	54.1096	54.1783	55.2670	55.6797	56.1514
56.5466	57.6423	57.9208	58.8355	59.1083	60.7877	60.8004	62.4030	62.4616	63.4282
68.6942	69.1637	69.3258	69.7916	69.9241	70.6923	71.4925	72.2906	72.3250	74.0639
74.5724	75.0137	75.7565	76.5480	78.1494	78.9535	80.4713			

NUMBER OF IMPACTS BY FACET:

FACET NO.	NO. OF IMPACTS
62	11
22	9
61	8
63	8
34	3
11	2
31	2
32	2
48	2
3	1
12	1
14	1
21	1
29	1
30	1
40	1
49	1
50	1
52	1

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Listing of IMPAC Program

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 -KSSIMPAC- VERSION 11 DATED 76293 ** LIBRARY MANAGEMENT SYSTEM ** 76293--12:12
 -KSSIMPAC- VERSION 11 DATED 76293 ** LIBRARY MANAGEMENT SYSTEM ** 76293--12:12

C--  MAIN  --  MAIN  --  MAIN  --  MAIN  --  MAIN  --  MAIN  --  MAIN  -00000100
      DIMENSION ALPHA(100,2), EPS(2), OMEGA(100), PHV(100), THV(100)     00000200
      DIMENSION TITLE(20), NAMPAR(10),PARAM(6), CORNR3(99,4,3), DESGPT   00000300
     1 (3), CORNR6(99,4,6), SUM(8), SSQ(8), HIT(100,3), VEL(3), AVG(8),  00000400
     2 SD(8), SIGEQ(6), LISTHT(99), HIT6(100,6), AIRSPD(100)             00000500
      DIMENSION HEADER(4,3), MLIST(100), RMLIST(100,2)                   00000600
      DATA HEADER / 'MISS', ' DIS', 'TANC', 'ES  ', 'YAW ', 'ERRO',      00000700
     1     'RS  ', '    ', '    ', 'PITC', 'H ER', 'RORS', '    ' /      00000800
      DATA PI /3.141593/, BLANKS /'    '/                                00000900
C                                                                        00001000
    1 FORMAT (20A4)                                                      00001100
    2 FORMAT(4I3, 8X, F10.0, 10X, 10A4)                                  00001200
    3 FORMAT (8F10.0)                                                    00001300
    4 FORMAT (12F6.2)                                                    00001400
    5 FORMAT (15X, 2F10.0, 3F15.6)                                       00001500
    6 FORMAT('1', T40, 'PROGRAM FOR STATISTICAL ANALYSIS OF GUIDANCE ERR00001600
     1OR'/ T37, 'AND ESTIMATING PROBABILITY OF HITTING A VEHICULAR TARGE00001700
     2T'// ' VEHICULAR TARGET REPRESENTED BY ', I2, ' CONVEX QUADRILATER00001800
     3AL FACETS WITH CORNER COORDINATES BY FACET:'/)                      00001900
    7 FORMAT (4(5X,3(F7.2,1X),4X)/)                                      00002000
    8 FORMAT(' ABOVE COORDINATES IN INCHES. 1ST COORDINATE IS DIST FORWA00002100
     1RD FROM TRAILING EDGE TIMES -1, 2ND HEIGHT ABOVE GROUND, 3RD DIST 00002200
     2TO'/ ' DRIVERS LEFT FROM CENTERLINE.')                             00002300
    9 FORMAT (40X, 4F10.0)                                               00002400
   10 FORMAT ('1RESULTS FOR ', F10.3, 1X, 10A4//                         00002500
     *        ' TARGET HEADING ', F7.2, ' DEGREES IN ZOT COORDINATE SYST00002600
     1EM'/' DESIGNATION POINT IN FACET COORDINATES ', 3(F7.2, 1X)/)       00002700
   11 FORMAT (35X, 3F15.6)                                               00002800
   12 FORMAT (T5,'MEANS', T16, 3(F10.4, 3X), 2X, 2(F10.4,3X), 2X, F10.4,00002900
     15X, 2(F10.4, 3X) / T5, 'STD DEVS',  T16, 3(F10.4, 3X), 2X,        00003000
     2 2(F10.4, 3X), 2X, F10.4, 5X, 2(F10.4, 3X) )                       00003100
   13 FORMAT (T27,'*NOTE:  PHI.V',' MEASURED CCW FROM +Z-AXIS IN ZOT SYS00003200
     1TEM.'//' YAW-PITCH CORRELATION ',F10.4/' SQUARE TARGET HIT PROBAB100003300
     2LITIES:  APPROX ',F10.5, ',  DERIVED ', F10.5, ' GIVEN ACQUISITION00003400
     3.'/' EQUIVALENT CIRCULAR-NORMAL STD DEV ', F10.5, ' FT'/' VEHICULA00003500
     4R TARGET HIT PROBABILITY:  APPROX ', F10.5, ' GIVEN ACQUISITION.')00003600
   14 FORMAT ('0SORTED ', 4A4, '(FT)')                                   00003700
   15 FORMAT (10(2X,F10.4))                                              00003800
   16 FORMAT ('0THERE WERE ', I3, ' MISSES!')                            00003900
   17 FORMAT (' REP ', I3, 5X, 'YAW ', F10.4, 5X, 'PITCH ', F10.4)       00004000
   18 FORMAT (' ANGLE-OF-ATTACK CORRELATIONS:  ALPHA.Y-ALPHA.P', F10.4,  00004100
     1 ' ALPHA.Y-ERR.Y', F10.4, ' ALPHA.P-ERR.P', F10.4 )                 00004200
   19 FORMAT ('1RESULTS FOR ', F10.3, 1X, 10A4)                          00004300
   20 FORMAT ('0OUTCOMES OF INDIVIDUAL REPLICATIONS:'/'0REP', T13, 'YAW'00004400
     1, T23, 'PITCH', T31, 'FACET NO.', T43, 'OBLIQUITY (DEG)', T62,     00004500
     2 'ALPHA.Y   ALPHA.P     PHI.V   THETA.V AIRSPEED (FPS) BETA.Y    B00004600
     3ETA.P'/ )                                                          00004700
   21 FORMAT ('0SORTED OBLIQUITIES (DEG):')                              00004800
   22 FORMAT (' OBLIQUITY MEAN', F10.4, ', STD. DEV.', F10.4, ' DEG')    00004900
   23 FORMAT ('0NUMBER OF IMPACTS BY FACET:'/T5, 'FACET NO.', T20, 'NO. 00005000
     1OF IMPACTS')                                                       00005100
   24 FORMAT (T8, I3, T26, I3)                                           00005200
   25 FORMAT('1', T25, 20A4// 1X, I1, ' SETS OF SAMPLE SIZE ', I3, ' VAR00005300
     1YING PARAMETER ', I0A4/ ' SQUARE TARGET WIDTH ', F10.3, ' FT'/     00005400
     2 ' ANALYSIS CONTROL PARAMETER IALPHA = ', I1/ ' POLYNOMIAL-FIT CON00005500
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     3TROL PARAMETER NGO = ', I1)                                                00005600
    26 FORMAT (1X, I3, '  DELETED -- FAILED TO ACQUIRE.' )                       00005700
    27 FORMAT (' APPROXIMATE PROBABILITY OF TARGET BEING IN ACQUISITION F00005800
     1OOTPRINT:', F10.5 )                                                       00005900
    28 FORMAT ('0POSITIONS OF GUIDED IMPACTS IN MEAN IMPACT PLANE:' )           00006000
    29 FORMAT ('0OUTCOMES:', T25, 'NUMBER', T40, 'FRACTION'/ 'OFAILED TO 00006100
     1ACQUIRE', T26, I3, T41, F7.5/' ACQUIRED BUT MISSED', T26, I3, T41,00006200
     2 F7.5/' ACQUIRED AND HIT', T26, I3, T41, F7.5/ )                          00006300
    30 FORMAT (                                //T16, 'MISS DIST', T29,        00006400
     1 'YAW ERROR', T42, 'PITCH ERROR', T57, 'PHI.V', T70, 'THETA.V',           00006500
     2 T85, 'SPEED', T100, 'ALPHA.Y', T113, 'ALPHA.P', /T30, '(FEET)',          00006600
     3 T64, '(DEGREES)', T85, '(FPS)', T107, '(DEGREES)' / T16, 36('-'),00006700
     4 5X, 23('-'), 5X, 10('-'), 5X, 23('-')  )                                 00006800
C                                                                               00006900
      DEGREE = 180./PI                                                          00007000
      READ(5,2) NFACET                                                          00007100
      IF (NFACET.LE.0)   STOP                                                   00007150
      READ (5,4) (((CORNR3(I,J,K), K=1,3), J=1,4), I=1, NFACET)                 00007200
      WRITE(6,6) NFACET                                                         00007300
      WRITE (6,7) (((CORNR3(I,J,K), K=1,3), J=1,4), I=1, NFACET)                00007400
      WRITE (6,8)                                                               00007450
   97 CONTINUE                                                                  00007500
      READ(5,1) TITLE                                                           00007600
      DO 98 I=1,20                                                              00007700
      IF (TITLE(I).NE.BLANKS)   GO TO 99                                        00007800
   98 CONTINUE                                                                  00007900
      STOP                                                                      00008000
   99 CONTINUE                                                                  00008100
      READ(5,2) NSETS, NSAMPL, IALPHA, NGO, WTGT, NAMPAR                        00008200
C                                                                               00008300
C--  THE CONTROL VARIABLE  IALPHA  SELECTS THE TYPE OF PROCESSING:              00008400
C         0 => DO NOT READ ALPHAS.  USED FOR OLD-STYLE ZOT CARDS HAVING 00008500
C              LABEL DATA IN ALPHAS' FIELDS.                                    00008600
C         1 => READ ALPHAS AND COMPUTE SUMMARY STATISTICS.                      00008700
C         2 => ALSO DISPLAY ALPHA-SCATTER PLOT                                  00008800
C         3 => ALSO PERFORM IMPACT OBLIQUITY ANALYSIS.                          00008900
C         4 => ALSO SCORE BY TRANSFORMING TARGET INTO INDIVIDUAL IMPACT 00009000
C              PLANES INSTEAD OF AVERAGE IMPACT PLANE.                          00009100
C                                                                               00009200
      WRITE(6,25) TITLE, NSETS, NSAMPL, NAMPAR, WTGT, IALPHA, NGO               00009300
      READ (5,3) (PARAM(I), I=1,NSETS)                                          00009400
      HFTGT = 0.5*WTGT                                                          00009500
      DO 276 ISET = 1, NSETS                                                    00009600
      READ (5,9) TGTHDG, DESGPT                                                 00009700
      IF(IALPHA.GE.3)WRITE(6,10)PARAM(ISET),NAMPAR,TGTHDG,DESGPT                00009800
C--  TRANSLATE & SCALE CORNERS OF VEHICULAR TARGET; STORE IN WORKING ARR00009900
      DO 120 I=1, NFACET                                                        00010000
      DO 110 J=1,4                                                              00010100
      DO 100 K=1,3                                                              00010200
  100 CORNR6(I,J,K) = (CORNR3(I,J,K)-DESGPT(K))/12.                             00010300
  110 CONTINUE                                                                  00010400
  120 CONTINUE                                                                  00010500
      GROUND = -DESGPT(2)/12.                                                   00010600
C                                                                               00010700
C--  CORNR3  CONTAINS THE FACET COORDINATES OF TARGET FACET CORNERS, AND00010800
C    IS NEVER OPERATED UPON.  CORNR6  IS THE WORKING AREA FOR FACET             00010900
C    CORNERS.  (CORNR6(I,J,K),K=1,3) CONTAINS CORNER COORDINATES WITH           00011000
C    RESPECT TO THE ORIGINAL FACET AXES, TRANSLATED TO ORIGIN AT THE            00011100
C    "DESIGNATION POINT" AND RESCALED FROM INCHES TO FEET.  (CORNR6(I,          00011200
C    J,K),K=4,6) WILL CONTAIN THE YAW, PITCH, AND DEPTH COORDINATES OF          00011300
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C     THE CORRESPONDING CORNERS.  THE PROJECTILE VELOCITY VECTOR (EITHER 00011400
C     FOR THE INDIVIDUAL SHOT, OR THE AVERAGE, AS APPROPRIATE) IS, BY    00011500
C     DEFINITION, IN THE MINUS-DEPTH DIRECTION.                          00011600
C                                                                        00011700
C--   INITIALIZE SUMS                                                    00011800
      DO 130 I=1,8                                                       00011900
      SUM(I) = 0.                                                        00012000
  130 SSQ(I) = 0.                                                        00012100
      HITS = 0.                                                          00012200
      SUMYP = 0.                                                         00012300
      SUMAA = 0.                                                         00012400
      SUMAYY = 0.                                                        00012500
      SUMAPP = 0.                                                        00012600
      PHVMAX = -10000.                                                   00012700
      PHVMIN = +10000.                                                   00012800
      NONAQS = 0                                                         00012900
      DO 150 I=1, NSAMPL                                                 00013000
C--   READ & COLLECT STATISTICS ON IMPACTS                               00013100
      READ (5,11) (HIT(I,J), J=1,3)                                      00013200
      IF (IALPHA.NE.0)   GO TO 135                                       00013300
C--   ANALYZE OLD-TYPE ZOT CARDS WITHOUT ANGLES OF ATTACK                00013400
      READ (5,11) VEL                                                    00013500
      DO 131 J=1,2                                                       00013600
  131 ALPHA(I,J) = 0.                                                    00013700
      GO TO 137                                                          00013800
  135 CONTINUE                                                           00013900
C--   ANALYZE NEW-TYPE ZOT CARDS CONTAINING ANGLES OF ATTACK (IN DEGREES)00014000
      READ (5,5) (ALPHA(I,J), J=1,2), VEL                                00014100
  137 CONTINUE                                                           00014200
      IF ( HIT(I,1).GE.0)   GO TO 139                                    00014300
      NONAQS = NONAQS + 1                                                00014400
      GO TO 150                                                          00014500
  139 CONTINUE                                                           00014600
      DO 140 J=1,3                                                       00014700
      SUM(J) = SUM(J) + HIT(I,J)                                         00014800
  140 SSQ(J) = SSQ(J) + HIT(I,J)**2                                      00014900
      VH = SQRT(VEL(1)**2 + VEL(2)**2)                                   00015000
      PHV(I) = ATAN2(VEL(1), VEL(2))                                     00015100
      IF (PHV(I).GT.PHVMAX)   PHVMAX = PHV(I)                            00015200
      IF (PHV(I).LT.PHVMIN)   PHVMIN = PHV(I)                            00015300
      THV(I) = ATAN2(-VEL(3), VH)                                        00015400
      AIRSPD(I) = SQRT(VH**2 + VEL(3)**2)                                00015500
C--   VELOCITIES ARE VX, VZ, -VY IN ZOT COORDINATES IN F/S.              00015600
      SUM(4) = SUM(4) + PHV(I)                                           00015700
      SSQ(4) = SSQ(4) + PHV(I)**2                                        00015800
      SUM(5) = SUM(5) + THV(I)                                           00015900
      SSQ(5) = SSQ(5) + THV(I)**2                                        00016000
      SUM(6) = SUM(6) + AIRSPD(I)                                        00016100
      SSQ(6) = SSQ(6) + AIRSPD(I)**2                                     00016200
      DO 145 J=7,8                                                       00016300
      SUM(J) = SUM(J) + ALPHA(I,J-6)                                     00016400
  145 SSQ(J) = SSQ(J) + ALPHA(I,J-6)**2                                  00016500
      SUMYP = SUMYP + HIT(I,2)*HIT(I,3)                                  00016600
      SUMAA = SUMAA + ALPHA(I,1)*ALPHA(I,2)                              00016700
      SUMAYY = SUMAYY + ALPHA(I,1)*HIT(I,2)                              00016800
      SUMAPP = SUMAPP + ALPHA(I,2)*HIT(I,3)                              00016900
      IF ((ABS(HIT(I,2)).GT.HFTGT).OR .(ABS(HIT(I,3)).GT.HFTGT))         00017000
     1     GO TO 150                                                     00017100
      HITS = HITS + 1.                                                   00017200
  150 CONTINUE                                                           00017300
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C--  CHECK VELOCITY AZIMUTHS                                                  00017400
      IF ((PHVMAX-PHVMIN).LT.PI)   GO TO 159                                  00017500
      SUM(4) = 0.                                                             00017600
      SSQ(4) = 0.                                                             00017700
      DO 155 I=1,NSAMPL                                                       00017800
      IF (HIT(I,1).EQ.-1.)   GO TO 155                                        00017900
      IF (PHV(I).LT.0.)   PHV(I) = PHV(I) + PI + PI                           0001800C
      SUM(4) = SUM(4) + PHV(I)                                                00018100
      SSQ(4) = SSQ(4) + PHV(I)**2                                             00018200
  155 CONTINUE                                                                00018300
  159 CONTINUE                                                                00018400
C--  COMPUTE MEAN & STD DEV OF MISS, YAW, PITCH, SSP, DEP, SPD               00018500
      RSAMPL = NSAMPL - NONAQS                                                00018600
      DO 160 I=1,8                                                            00018700
      AVG(I) = SUM(I)/RSAMPL                                                  00018800
      HOLD = (RSAMPL*SSQ(I) - SUM(I)**2) / (RSAMPL*(RSAMPL-1))                00018900
      IF (HOLD.LT.0.)   HOLD = 0.                                             00019000
  160 SD(I) = SQRT(HOLD)                                                      00019100
C--  YAW-PITCH CORRELATION                                                    00019200
      RYP = (SUMYP - RSAMPL*AVG(2)*AVG(3))/((RSAMPL-1)*SD(2)*SD(3))           00019300
C--  ANGLE-OF-ATTACK CORRELATIONS                                             00019400
      RAA = 0.                                                                00019500
      RAYY = 0.                                                               00019600
      RAPP = 0.                                                               00019700
      IF (IALPHA.EQ.0)   GO TO 165                                            00019800
      RAA = (SUMAA - RSAMPL*AVG(7)*AVG(8)) / ((RSAMPL-1)*SD(7)*SD(8))         00019900
      RAYY = (SUMAYY - RSAMPL*AVG(7)*AVG(2)) / ((RSAMPL-1)*SD(7)*SD(2))       00020000
      RAPP = (SUMAPP - RSAMPL*AVG(8)*AVG(3)) / ((RSAMPL-1)*SD(8)*SD(3))       00020100
  165 CONTINUE                                                                00020200
C--  APPROX PH ON SQUARE TARGET                                               00020300
      APHSQT = HITS/RSAMPL                                                    00020400
C--  PH ON SQUARE TARGET                                                      00020500
      PYAW   = SNORM((HFTGT-AVG(2))/SD(2)) - SNORM((-HFTGT-AVG(2))/SD(2))     00020600
      PPITCH= SNORM((HFTGT-AVG(3))/SD(3)) - SNORM((-HFTGT-AVG(3))/SD(3))      00020700
      PHSQT = PYAW*PPITCH                                                     00020800
C--  EQUIVALENT CIRCULAR-NORMAL STD DEV                                       00020900
      IF (PHSQT.LE.0.99)   GO TO 170                                          00021000
      SIGEQ(ISET) = 0.5*( SD(2) + SD(3) )                                     00021100
      GO TO 180                                                               00021200
  170 SIGEQ(ISET) = HFTGT / XNORM( (1.+SQRT(PHSQT))*0.5 )                     00021300
  180 CONTINUE                                                                00021400
      IF (IALPHA.GT.3)   GO TO 201                                            00021500
C--  COMPUTE VEHICULAR TARGET CORNER POSITIONS IN MEAN-IMPACT-PLANE           00021600
C    COORDINATES FOR MEAN-IMPACT-PLANE PROCESSING OPTIONS (IALPHA.LT.4)       00021700
      BETA = PI + AVG(4) - TGTHDG/DEGREE                                      00021800
      SB = SIN(BETA)                                                          00021900
      CB = COS(BETA)                                                          00022000
      SA =-SIN(AVG(5))                                                        00022100
      CA = COS(AVG(5))                                                        00022200
      DO 200 I=1,NFACET                                                       00022300
      DO 190 J=1,4                                                            00022400
      IF (IALPHA.GE.3)   CORNR6(I,J,6) = -CA*CB*CORNR6(I,J,1) +               00022500
     1     SA*CORNR6(I,J,2) + CA*SB*CORNR6(I,J,3)                             00022600
      CORNR6(I,J,4) = SB*CORNR6(I,J,1) + CB*CORNR6(I,J,3)                     00022700
  190 CORNR6(I,J,5) = SA*CB*CORNR6(I,J,1) + CA*CORNR6(I,J,2)                  0002280C
     1     - SA*SB*CORNR6(I,J,3)                                              00022900
  200 CONTINUE                                                                00023000
  201 CONTINUE                                                                00023100
C--  BEGIN TO SCORE HITS ON VEHICULAR TARGET                                  00023200
      IF (IALPHA.GE.3)   WRITE (6,20)                                         00023300
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      SOM = 0.                                                          00023400
      SSOM = 0.                                                         00023500
      HITS = 0.                                                         00023600
      MISSES = 0                                                        00023700
      DO 202 I=1,NFACET                                                 00023800
  202 LISTHT(I) = 0                                                     00023900
C                                                                       00024000
C--   BEGIN REPLICATIONS LOOP                                           00024100
      DO 210 IMPACT = 1, NSAMPL                                         00024200
      OMEGA(IMPACT) = 10000.                                            00024300
      IF (MIT(IMPACT,1).GE.0.)   GO TO 204                              00024400
      DO 203 J=1,3                                                      00024500
  203 HIT(IMPACT,J) = 10000.                                            00024600
      WRITE (6,26) IMPACT                                               00024700
      GO TO 210                                                         00024800
  204 CONTINUE                                                          00024900
      IF (IALPHA.LT.4)   GO TO 2204                                     00025000
C--   COMPUTE VEHICULAR TARGET CORNER POSITIONS IN INDIVIDUAL-IMPACT-   00025100
C     PLANE COORDINATES FOR HIGH OPTIONS (IALPHA.GE.4)                  00025200
      BETA = PI + PHV(IMPACT) - TGTHDG/DEGREE                           00025300
      SB = SIN(BETA)                                                    00025400
      CB = COS(BETA)                                                    00025500
      SA = -SIN(THV(IMPACT))                                            00025600
      CA =  COS(THV(IMPACT))                                            00025700
      DO 1204 I=1,NFACET                                                00025800
      DO 1204 J=1,4                                                     00025900
      CORNR6(I,J,4) = SB*CORNR6(I,J,1) + CB*CORNR6(I,J,3)               00026000
      CORNR6(I,J,5) = SA*CB*CORNR6(I,J,1) + CA*CORNR6(I,J,2) - SA*SB*   00026100
     1      CORNR6(I,J,3)                                               00026200
 1204 CORNR6(I,J,6) = -CA*CB*CORNR6(I,J,1) + SA*CORNR6(I,J,2) + CA*SB*  00026300
     1      CORNR6(I,J,3)                                               00026400
      EPS(1) = 0.                                                       00026500
      EPS(2) = 0.                                                       00026600
      GO TO 3204                                                        00026700
 2204 CONTINUE                                                          00026800
      EPS(1) = (PHV(IMPACT) - AVG(4))*COS(THV(IMPACT))                  00026900
      EPS(2) = THV(IMPACT) - AVG(5)                                     00027000
 3204 CONTINUE                                                          00027100
      CALL SCORE1(IMPACT,HIT,CORNR6,NFACET,IHITIT,IALPHA,OMEGA,ALPHA,   00027200
     1      EPS, LISTHT, HIT6, SA, CA, GROUND, PHV,THV, AIRSPD)         00027300
      HITS = HITS + IHITIT                                              00027400
      IF (IALPHA.LT.4) GO TO 4204                                       00027500
C--   COMPUTE IMPACT POINT IN TARGET FRAME OF REFERENCE                 00027600
      HIT6(IMPACT,1) = SB*HIT6(IMPACT,4) + SA*CB*HIT6(IMPACT,5) -       00027700
     1      CA*CB*HIT6(IMPACT,6)                                        00027800
      HIT6(IMPACT,2) = CA*HIT6(IMPACT,5) + SA*HIT6(IMPACT,6)            00027900
      HIT6(IMPACT,3) = CB*HIT6(IMPACT,4) - SA*SB*HIT6(IMPACT,5) +       00028000
     1      CA*SB*HIT6(IMPACT,6)                                        00028100
 4204 CONTINUE                                                          00028200
      IF (IHITIT.NE.1)   GO TO 205                                      00028300
      IF (IALPHA.LT.3)   GO TO 210                                      00028400
      SOM = SOM + OMEGA(IMPACT)                                         00028500
      SSOM = SSOM + OMEGA(IMPACT)**2                                    00028600
      GO TO 210                                                         00028700
  205 CONTINUE                                                          00028800
      MISSES = MISSES + 1                                               00028900
      MLIST(MISSES) = IMPACT                                            00029000
      RMLIST(MISSES,1) = HIT(IMPACT,2)                                  00029100
      RMLIST(MISSES,2) = HIT(IMPACT,3)                                  00029200
  210 CONTINUE                                                          00029300
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C--   END REPLICATIONS LOOP --                                                  00029400
C                                                                               00029500
C--   APPROX PH ON VEHICULAR TARGET                                             00029600
      APHVTG = HITS/RSAMPL                                                      00029700
C--   APPROX PROB OF ACQ (TARGET IN ACQ FOOTPRINT)                              00029800
      APACQ = RSAMPL/NSAMPL                                                     00029900
C--   COMPUTE IMPACT LOCATIONS IN "MEAN IMPACT PLANE" FOR DISPLAY               00030000
      IF (IALPHA.GT.3)   GO TO 212                                              00030100
      DO 211 I=1,NSAMPL                                                         00030200
      HIT6(I,4) = HIT(I,2)                                                      00030300
  211 HIT6(I,5) = HIT(I,3)                                                      00030400
      GO TO 216                                                                 00030500
  212 CONTINUE                                                                  00030600
      BETA = PI + AVG(4) - TGTHDG/DEGREE                                        00030700
      SB = SIN(BETA)                                                            00030800
      CB = COS(BETA)                                                            00030900
      SA = -SIN(AVG(5))                                                         00031000
      CA =  COS(AVG(5))                                                         00031100
      DO 214 I=1,NSAMPL                                                         00031200
      IF (HIT(I,2).NE.10000.)   GO TO 213                                       00031300
      HIT6(I,4) = 10000.                                                        00031400
      HIT6(I,5) = 10000.                                                        00031500
      GO TO 214                                                                 00031600
  213 CONTINUE                                                                  00031700
      HIT6(I,4) = SB*HIT6(I,1) + CB*HIT6(I,3)                                   00031800
      HIT6(I,5) = SA*CB*HIT6(I,1) + CA*HIT6(I,2) - SA*SB*HIT6(I,3)              00031900
  214 CONTINUE                                                                  00032000
      IF (IALPHA.LT.4)   GO TO 216                                              00032100
      WRITE (6,28)                                                              00032200
      DO 215 J=1,NSAMPL                                                         00032300
      IF (HIT6(J,4).EQ.10000.)   GO TO 215                                      00032400
      WRITE (6,17) J, HIT6(J,4), HIT6(J,5)                                      00032500
  215 CONTINUE                                                                  00032600
  216 CONTINUE                                                                  00032700
      IF (IALPHA.LT.4)   GO TO 219                                              00032705
C--   COMPUTE VEHICULAR TARGET CORNER POSITIONS IN "MEAN-IMPACT-PLANE"          00032710
C     COORDINATES FOR DISPLAY                                                   00032711
      BETA = PI + AVG(4) - TGTHDG/DEGREE                                        00032715
      SB = SIN(BETA)                                                            00032720
      CB = COS(BETA)                                                            00032725
      SA = -SIN(AVG(5))                                                         00032730
      CA =  COS(AVG(5))                                                         00032735
      DO 218 I=1,NFACET                                                         00032740
      DO 217 J=1,4                                                              00032745
      CORNR6(I,J,4) = SB*CORNR6(I,J,1) + CB*CORNR6(I,J,3)                       00032750
  217 CORNR6(I,J,5) = SA*CB*CORNR6(I,J,1) + CA*CORNR6(I,J,2)                    00032755
     1      - SA*SB*CORNR6(I,J,3)                                              00032760
  218 CONTINUE                                                                  00032765
  219 CONTINUE                                                                  00032770
C--   CREATE AND PRINT SCATTER PLOT                                             00032800
      WRITE (6,10) PARAM(ISET), NAMPAR, TGTHDG, DESGPT                          00032900
      CALL SCTPLT (NSAMPL, HIT6,NFACET, CORNR6, 10., 20., ALPHA, IALPHA)        00033000
C--   SORT MISS COMPONENTS                                                      00033100
      NM1 = NSAMPL - 1                                                          00033200
      DO 240 I=1, NM1                                                           00033300
      IP1 = I + 1                                                               00033400
      DO 230 J=IP1, NSAMPL                                                      00033500
      DO 220 K=1,3                                                              00033600
      IF (HIT(I,K).LC.HIT(J,K))   GO TO 220                                     00033700
      HOLD = HIT(I,K)                                                           00033800
```

```
      HIT(I,K) = HIT(J,K)                                                00033900
      HIT(J,K) = HOLD                                                    00034000
  220 CONTINUE                                                           00034100
  230 CONTINUE                                                           00034200
  240 CONTINUE                                                           00034300
C--   SORT OBLIQUITIES AND CREATE CUMULATIVE PLOT                        00034400
      IF(IALPHA.LT.3)   GO TO 249                                        00034500
      DO 242 I=1,NM1                                                     00034600
      IP1 = I + 1                                                        00034700
      DO 241 J=IP1,NSAMPL                                                00034800
      IF (OMEGA(I).LE.OMEGA(J))   GO TO 241                              00034900
      HOLD = OMEGA(I)                                                    00035000
      OMEGA(I) = OMEGA(J)                                                00035100
      OMEGA(J) = HOLD                                                    00035200
  241 CONTINUE                                                           00035300
  242 CONTINUE                                                           00035400
      CALL CUMPLT (OMEGA, HITS, 0., 100.)                                00035500
  249 CONTINUE                                                           00035600
C--   SUMMARY REPORT                                                     00035700
      DO 250 I=4,5                                                       00035800
      AVG(I) = AVG(I) * DEGREE                                           00035900
      SD(I) = SD(I) * DEGREE                                             00036000
  250 CONTINUE                                                           00036100
      WRITE (6,19) PARAM(ISET), NAMPAR                                   00036200
      PFAIL = FLOAT(NONAQS) / FLOAT(NSAMPL)                              00036300
      PMISS = FLOAT(MISSES) / FLOAT(NSAMPL)                              00036400
      PHIT = 1. - PFAIL - PMISS                                          00036500
      NHIT = NSAMPL -NONAQS - MISSES                                     00036600
      WRITE (6,29) NONAQS, PFAIL, MISSES, PMISS, NHIT, PHIT              00036700
      WRITE (6,27) APACQ                                                 00036800
      WRITE (6,30)                                                       00036900
      WRITE (6,12) AVG, SD                                               00037000
      WRITE (6,13) RYP, APHSQT, PHSQT, SIGEQ(ISET), APHVTG               00037100
      WRITE (6,18) RAA, RAYY, RAPP                                       00037200
      IF (IALPHA.LT.3)   GO TO 255                                       00037300
      AVGOM = SOM/HITS                                                   00037400
      HOLD = (HITS*SSOM-SOM**2) / (HITS*(HITS-1.))                       00037500
      IF (HOLD.LT.0.)   HOLD = 0.                                        00037600
      SDOM = SQRT(HOLD)                                                  00037700
      WRITE (6,22) AVGOM, SDOM                                           00037800
  255 CONTINUE                                                           00037900
      N = RSAMPL                                                         00038000
      DO 260 J=1,3                                                       00038100
      WRITE (6,14) (HEADER(I,J), I=1,4)                                  00038200
  260 WRITE (6,15) (HIT(I,J), I=1,N)                                     00038300
      IF (IALPHA.GE.3)   GO TO 290                                       00038400
      WRITE (6,16) MISSES                                                00038500
      IF (MISSES.EQ.0)   GO TO 276                                       00038600
      DO 265 I=1,MISSES                                                  00038700
  265 WRITE (6,17) MLIST(I), (RMLIST(I,J), J=1,2)                        00038800
      GO TO 276                                                          00038900
  290 CONTINUE                                                           00039000
      WRITE (6,21)                                                       00039100
      J = HITS                                                           00039200
      WRITE(6,15) (OMEGA(I), I=1,J)                                      00039300
  270 CONTINUE                                                           00039400
      WRITE (6,23)                                                       00039500
  272 MXHITS = 0                                                         00039600
      DO 274 I=1,NFACET                                                  00039700
      IF (LISTHT(I).LE.MXHITS)   GO TO 274                               00039800
```

```
      MXHITS = LISTHT(I)                                                00039900
      IFACET = I                                                        00040000
  274 CONTINUE                                                          00040100
      IF (MXHITS.LE.0)   GO TO 276                                      00040200
      WRITE (6,24) IFACET, MXHITS                                       00040300
      LISTHT(IFACET) = 0                                                00040400
      GO TO 272                                                         00040500
  276 CONTINUE                                                          00040600
      IF (NGO.NE.1)   GO TO 280                                         00040700
      CALL FITPOL (NSETS, SIGEQ, PARAM)                                 00040800
  280 CONTINUE                                                          00040900
      GO TO 97                                                          00041000
      END                                                               00041100
C--  SCORE1 -- SCORE1 -- SCORE1 -- SCORE1 -- SCORE1 -- SCORE1           00041200
      SUBROUTINE SCORE1(IMPACT,HIT,CORNER,NFACET,IHITIT,IALPHA,OMEGA,   00041300
     1     ALPHA,EPS, LISTHT, HIT6, SA, CA, GROUND, PHV, THV, AIRSPD)   00041400
      DIMENSION HIT(100,3), CORNER(99,4,6), XVRTX(4), YVRTX(4),         00041500
     1     OMEGA(100),ALPHA(100,2),EPS(2),IFACET(99), LISTHT(99)        00041600
     2     , HIT6(100,6), PHV(100), THV(100), AIRSPD(100)               00041700
      DATA DEGREE / 57.29578 /                                          00041800
    1 FORMAT (1X, I3, T7, F10.4, T19, F10.4, T33, 'MISSED', T59,4F10.4, 00041900
     1 2F11.4, F10.4)                                                   00042000
    2 FORMAT (' ***ERROR***ZERO DENOMINATOR')                           00042100
    3 FORMAT (' ***ERROR***NO FACET FOUND BY FIRST-HIT ROUTINE')        00042200
    4 FORMAT (1X, I3, T7, F10.4, T19, F10.4, T34, I3, T45, F10.4, T59,  00042300
     1 4F10.4, 2F11.4, F10.4)                                           00042400
C--  SCORE1 SCORES ONE IMPACT AGAINST ALL FACETS OF TARGET; FOR IALPHA  00042500
C     < 3 FIND ONLY WHETHER TARGET IS HIT; FOR IALPHA = 3 PERFORM IMPACT 00042600
C     OBLIQUITY ANALYSIS.                                               00042700
      IHITIT = 0                                                        00042800
      XIMP = HIT(IMPACT,2)                                              00042900
      YIMP = HIT(IMPACT,3)                                              00043000
      HIT6(IMPACT,4) = XIMP                                             00043100
      HIT6(IMPACT,5) = YIMP                                             00043200
      DO 20 I=1,NFACET                                                  00043300
      DO 10 J=1,4                                                       00043400
      XVRTX(J) = CORNER(I,J,4)                                          00043500
   10 YVRTX(J) = CORNER(I,J,5)                                          00043600
      CALL FACET (XVRTX, YVRTX, XIMP, YIMP, IHIT)                       00043700
      IFACET(I) = IHIT                                                  00043800
      IF (IHIT.NE.1)   GO TO 20                                         00043900
      IHITIT = 1                                                        00044000
      IF (IALPHA.LT.3)   RETURN                                         00044100
   20 CONTINUE                                                          00044200
      IF (IALPHA.LT.2)   RETURN                                         00044300
      IF (IALPHA.LT.4)   GO TO 25                                       00044400
C--  CALCULATE DEPTHWISE COORDINATE OF IMPACT ON GROUND                 00044500
      HIT6(IMPACT,6) = -CA/SA*HIT6(IMPACT,5) + GROUND/SA                00044600
   25 CONTINUE                                                          00044700
      PHB = EPS(1) + ALPHA(IMPACT,1)/DEGREE                             00044800
      THB = EPS(2) + ALPHA(IMPACT,2)/DEGREE                             00044900
      DPHB = PHB*DEGREE                                                 00045000
      DTHB = THB*DEGREE                                                 00045100
      PHI = PHV(IMPACT)*DEGREE                                          00045200
      THETA = THV(IMPACT) *DEGREE                                       00045300
      IF (IHITIT.EQ.1)   GO TO 30                                       00045400
      WRITE(6,1) IMPACT, XIMP, YIMP, (ALPHA(IMPACT,I),I=1,2), PHI,      00045500
     1     THETA, AIRSPD(IMPACT), DPHB, DTHB                            00045600
      RETURN                                                            00045700
   30 CONTINUE                                                          00045800
```

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C--  NOW FIND FIRST-HIT FACET                                                00045900
      MHIT = 0                                                               00046000
      ZMAX = -10000.                                                         00046100
      DO 50 I=1,NFACET                                                       00046200
      IF (IFACET(I).EQ.0)   GO TO 50                                         00046300
      A1 = CORNER(I,2,4) - CORNER(I,1,4)                                     00046400
      A2 = CORNER(I,3,4) - CORNER(I,2,4)                                     00046500
      A3 = XIMP - CORNER(I,2,4)                                              00046600
      A4 = CORNER(I,2,5) - CORNER(I,1,5)                                     00046700
      A5 = CORNER(I,3,5) - CORNER(I,2,5)                                     00046800
      A6 = YIMP - CORNER(I,2,5)                                              00046900
      A7 = CORNER(I,2,6) - CORNER(I,1,6)                                     00047000
      A8 = CORNER(I,3,6) - CORNER(I,2,6)                                     00047100
      A9 = -CORNER(I,2,6)                                                    00047200
      ANUM = A1*A5*A9 + A2*A6*A7 + A3*A4*A8 - A1*A6*A8 - A2*A4*A9 -          00047300
     1                A3*A5*A7                                              00047400
      DENOM = A2*A4 - A1*A5                                                  00047500
      IF (DENOM.NE.0.0)   GO TO 40                                           00047600
      WRITE (6,2)                                                            00047700
      STOP                                                                   00047800
   40 CONTINUE                                                               00047900
      ZIMP = ANUM/DENOM                                                      00048000
      IF (ZIMP.LE.ZMAX)   GO TO 50                                           00048100
      ZMAX = ZIMP                                                            00048200
      MHIT = I                                                               00048300
   50 CONTINUE                                                               00048400
      IF (MHIT.GT.0)   GO TO 60                                              00048500
      WRITE(6,3)                                                             00048600
      STOP                                                                   00048700
   60 CONTINUE                                                               00048800
      LISTHT(MHIT) = LISTHT(MHIT)+ 1                                         00048900
      HIT6(IMPACT,6) = ZMAX                                                  00049000
C--  NOW FIND OBLIQUITY TO IMPACTED FACET.                                   00049100
      A1 = CORNER(MHIT,2,4) - CORNER(MHIT,1,4)                               00049200
      A2 = CORNER(MHIT,2,5) - CORNER(MHIT,1,5)                               00049300
      A3 = CORNER(MHIT,2,6) - CORNER(MHIT,1,6)                               00049400
      A4 = CORNER(MHIT,3,4) - CORNER(MHIT,2,4)                               00049500
      A5 = CORNER(MHIT,3,5) - CORNER(MHIT,2,5)                               00049600
      A6 = CORNER(MHIT,3,6) - CORNER(MHIT,2,6)                               00049700
      A7 = A5*A3 - A2*A6                                                     00049800
      A8 = A1*A6 - A4*A3                                                     00049900
      A9 = A4*A2 - A1*A5                                                     00050000
      H = SQRT(A7**2+A9**2)                                                  00050100
      THN = ATAN2(A8,H)                                                      00050200
      PHN = ATAN2(-A7,-A9)                                                   00050300
      OMEGA(IMPACT) = DEGREE * ARCOS( COS(THB)*COS(THN)*( COS(PHB)*          00050400
     1      COS(PHN) + SIN(PHB)*SIN(PHN) ) + SIN(THB)*SIN(THN) )             00050500
      WRITE (6,4) IMPACT, XIMP, YIMP, MHIT, OMEGA(IMPACT), (ALPHA(IMPACT    00050600
     1     ,I),I=1,2), PHI, THETA, AIRSPD(IMPACT), DPHB, DTHB                00050700
      RETURN                                                                 00050800
      END                                                                    00050900
C--  FACET  --  FACET  --  FACET  --  FACET  --  FACET  --  FACET  --  F     00051000
      SUBROUTINE FACET (XVRTX, YVRTX, XIMP, YIMP, IHIT)                      00051100
      DIMENSION XVRTX(4), YVRTX(4)                                           00051200
C--  FACET SCORES ONE IMPACT AGAINST ONE FACET OF TARGET                     00051300
      XIN = (XVRTX(1) + XVRTX(3)) * 0.5                                      00051400
      YIN = (YVRTX(1) + YVRTX(3)) * 0.5                                      00051500
      DO 50 I=1,4                                                            00051600
      J=I+1                                                                  00051700
      IF (J.EQ.5)   J=1                                                      00051800
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      IF ((ABS(XVRTX(I)-XVRTX(J))).GE. 1.E-4 )   GO TO 20                00051900
      IF ( ABS(YVRTX(I)-YVRTX(J)) .GE. 1.E-4 )   GO TO 10                00052000
C--   LINE IS END-ON, SO NOT POSSIBLE TO HIT SURFACE                     00052100
      IHIT = 0                                                           00052200
      RETURN                                                             00052300
   10 CONTINUE                                                           00052400
C--   LINE IS VERTICAL                                                   00052500
      XAVCTR = XVRTX(I) - XIN                                            00052600
      YAVCTR = 0.                                                        00052700
      XBVCTR = XVRTX(I) - XIMP                                           00052800
      YBVCTR = 0.                                                        00052900
      GO TO 40                                                           00053000
   20 CONTINUE                                                           00053100
      IF ( ABS(YVRTX(I)-YVRTX(J)) .GE. 1.E-4)   GO TO 30                 00053200
C--   LINE IS HORIZONTAL                                                 00053300
      XAVCTR = 0.                                                        00053400
      YAVCTR = YVRTX(I) - YIN                                            00053500
      XBVCTR = 0.                                                        00053600
      YBVCTR = YVRTX(I) - YIMP                                           00053700
      GO TO 40                                                           00053800
   30 CONTINUE                                                           00053900
C--   LINE IS SLANTED                                                    00054000
      SLOPE = (YVRTX(J)-YVRTX(I)) / (XVRTX(J)-XVRTX(I))                  00054100
      XAVCTR = ( SLOPE**2 *XVRTX(I) + SLOPE*(YIN-YVRTX(I)) + XIN ) /     00054200
     1     ( SLOPE**2 + 1. )                                             00054300
      YAVCTR = YVRTX(I) + SLOPE*(XAVCTR-XVRTX(I))                        00054400
      XBVCTR = ( SLOPE**2 *XVRTX(I) + SLOPE*(YIMP-YVRTX(I)) + XIMP ) /   00054500
     1     ( SLOPE**2 + 1. )                                             00054600
      YBVCTR = YVRTX(I) + SLOPE*(XBVCTR-XVRTX(I))                        00054700
      XAVCTR = XAVCTR - XIN                                              00054800
      YAVCTR = YAVCTR - YIN                                              00054900
      XBVCTR = XBVCTR - XIMP                                             00055000
      YBVCTR = YBVCTR - YIMP                                             00055100
   40 ADOTB = XAVCTR*XBVCTR + YAVCTR*YBVCTR                              00055200
      IF (ADOTB.GE.0.)   GO TO 50                                        00055300
      IHIT = 0                                                           00055400
      RETURN                                                             00055500
   50 CONTINUE                                                           00055600
      IHIT = 1                                                           00055700
      RETURN                                                             00055800
      END                                                                00055900
C--   SCTPLT  --  SCTPLT  --  SCTPLT  --  SCTPLT  --  SCTPLT  --  SCTPLT  00056000
      SUBROUTINE SCTPLT (NSAMPL,HIT6,NFACET,CORNER,SIZE1,SIZE2,ALPHA,    00056100
     1           IALPHA)                                                 00056200
      INTEGER ARRAY(51,101,2)                                            00056300
      DIMENSION HIT6(100,6), CORNER(99,4,6), YLABEL(9), XLABEL(11)       00056400
      DIMENSION ICHAR(11), ALPHA(100,2)                                  00056500
      EQUIVALENCE (ICHAR(1), IBLANK)                                     00056600
      DATA ICHAR / ' ','*', '2', '3', '4', '5', '6', '7', '8', '9', 'X'/ 00056700
      DATA IDASH, IHASH, KORNER / '-', '|', '0' /                        00056800
    2 FORMAT (T16, 101A1)                                                00056900
    3 FORMAT (T8, F6.2, T16, 101A1)                                      00057000
    4 FORMAT (T13, 11(F6.2, 4X))                                         00057100
    5 FORMAT ('+', T16, 101A1)                                           00057200
    6 FORMAT ( /T24, 'IMPACT-PLANE SCATTER PLOT OF IMPACTS AND TARGET CO 00057300
     1RNERS RELATIVE TO DESIGNATION POINT')                              00057400
    7 FORMAT ('1')                                                       00057500
    8 FORMAT (/ T44, 'FREQUENCY PLOT OF TERMINAL ANGLES OF ATTACK')      00057600
      ILINE(Y,S) = IFIX(26.5 - 30.*Y/S)                                  00057700
      IKOLUM(X,S) = IFIX(51.5 + 50.*X/S)                                 00057800
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      JALPHA = LIMITR (IALPHA,1,2)                                      00057900
      DO 260 KALPHA = 1, JALPHA                                         00058000
      SIZE = SIZE1                                                      00058100
      IF (KALPHA.EQ.2)   SIZE = SIZE2                                   00058200
C--   INITIALIZE ARRAY                                                  00058300
      DO 20 I=1,51                                                      00058400
      DO 10 J=1,101                                                     00058500
      ARRAY(I,J,1) = IBLANK                                             00058600
   10 ARRAY(I,J,2) = 0                                                  00058700
   20 CONTINUE                                                          00058800
C--   CREATE HORIZONTAL GRID, VERTICAL LABELS                           00058900
      DO 40 I=1,9                                                       00059000
      LINE = 6*I - 4                                                    00059100
      VLABEL(I) = (-.2*I + 1.)*SIZE                                     00059200
      DO 30 KOL=1,101                                                   00059300
   30 ARRAY(LINE,KOL,1) = IDASH                                         00059400
   40 CONTINUE                                                          00059500
C--   CREATE VERTICAL GRID, HORIZONTAL LABELS                           00059600
      DO 60 I=1,11                                                      00059700
      KOL = 10*I - 9                                                    00059800
      HLABEL(I) = (.2*I - 1.2)*SIZE                                     00059900
      DO 50 LINE=1,51                                                   00060000
   50 ARRAY(LINE,KOL,1) = IHASH                                         00060100
   60 CONTINUE                                                          00060200
      IF (KALPHA.EQ.2)   GO TO 95                                       00060300
C--   OVERLAY FACET CORNERS                                             00060400
      DO 80 IFACET=1,NFACET                                             00060500
      DO 70 J=1,4                                                       00060600
      KOL = IKOLUM(CORNER(IFACET,J,4), SIZE)                            00060700
      LINE = ILINE(CORNER(IFACET,J,5), SIZE)                            00060800
      KOL = LIMITR(KOL,1,101)                                           00060900
      LINE = LIMITR(LINE,1,51)                                          00061000
   70 ARRAY(LINE,KOL,1) = KORNER                                        00061100
   80 CONTINUE                                                          00061200
C--   CREATE SCATTER PLOT                                               00061300
      DO 90 I=1,NSAMPL                                                  00061400
      IF (HIT6(I,4).EQ.10000.)   GO TO 90                               00061500
      KOL = IKOLUM(HIT6(I,4), SIZE)                                     00061600
      LINE = ILINE(HIT6(I,5), SIZE)                                     00061700
      KOL = LIMITR(KOL,1,101)                                           00061800
      LINE = LIMITR(LINE,1,51)                                          00061900
      ARRAY(LINE,KOL,2) = ARRAY(LINE,KOL,2) + 1                         00062000
   90 CONTINUE                                                          00062100
      GO TO 110                                                         00062200
   95 CONTINUE                                                          00062300
      DO 100 I=1, NSAMPL                                                00062400
      IF (HIT6(I,4).EQ.10000.)   GO TO 100                              00062500
      KOL = IKOLUM(ALPHA(I,1),SIZE)                                     00062600
      LINE = ILINE(ALPHA(I,2),SIZE)                                     00062700
      KOL = LIMITR(KOL,1,101)                                           00062800
      LINE = LIMITR(LINE,1,51)                                          00062900
      ARRAY(LINE,KOL,2) = ARRAY(LINE,KOL,2) + 1                         00063000
  100 CONTINUE                                                          00063100
  110 CONTINUE                                                          00063200
C--   CONVERT SCATTERPLOT TO ALPHA CHARACTERS                           00063300
      DO 220 LINE = 1,51                                                00063400
      DO 210 KOL = 1,101                                                00063500
      N = ARRAY(LINE,KOL,2) + 1                                         00063600
      IF (N.GT.11)   N = 11                                             00063700
      ARRAY(LINE,KOL,2) = ICHAR(N)                                      00063800
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  210 CONTINUE                                                          00063900
  220 CONTINUE                                                          00064000
C--  PRINT SCATTER PLOT                                                 00064100
      L = 1                                                             00064200
      DO 250 LINE = 1, 51                                               00064300
      N = (LINE+4)/6*6 - (LINE+4)                                       00064400
      IF (N.EQ.0)   GO TO 230                                           00064500
      WRITE (6,2)  (ARRAY(LINE,KOL,1), KOL=1,101)                       00064600
      GO TO 240                                                         00064700
  230 WRITE(6,3) VLABEL(L), (ARRAY(LINE,KOL,1), KOL=1,101)              00064800
      L=L+1                                                             00064900
  240 CONTINUE                                                          00065000
      WRITE (6,5) (ARRAY(LINE,KOL,2), KOL=1,101)                        00065100
  250 CONTINUE                                                          00065200
      WRITE (6,4) HLABEL                                                00065300
      IF(KALPHA.EQ.1)   WRITE (6,6)                                     00065400
      IF ((KALPHA.EQ.1).AND.(JALPHA.EQ.2))   WRITE (6,7)                00065500
      IF (KALPHA.EQ.2)   WRITE (6,8)                                    00065600
  260 CONTINUE                                                          00065700
      RETURN                                                            00065800
      END                                                               00065900
C--  LIMITR -- LIMITR -- LIMITR -- LIMITR -- LIMITR -- LIMITR -- LIMITR 00066000
      FUNCTION LIMITR (INPUT, MIN, MAX)                                 00066100
      LIMITR = INPUT                                                    00066200
      IF (INPUT.LT.MIN)   LIMITR = MIN                                  00066300
      IF (INPUT.GT.MAX)   LIMITR = MAX                                  00066400
      RETURN                                                            00066500
      END                                                               00066600
C--  FITPOL -- FITPOL -- FITPOL -- FITPOL -- FITPOL -- FITPOL -- FITPOL 00066700
      SUBROUTINE FITPOL (NOBS, Y, XIN)                                  00066800
      IMPLICIT REAL*8 (A-H,O-Z)                                         00066900
      REAL*4 Y, XIN                                                     00067000
      DIMENSION YY(6)                                                   00067100
      DIMENSION Y(6), XIN(6), X(6,6), XT(6,6), B(6), XTX(6,6), XTY(6)   00067200
    1 FORMAT ('1FITTED POLYNOMIAL:'/' YHAT  =  ',D15.8,'  +  ',D15.8,   00067300
     1 ' * X',T55,D15.8,T52,'+',T71,'* X**2',T82,D15.8,T79,'+',T98,      00067400
     2 '* X**3')                                                        00067500
    2 FORMAT (2(5X, E15.8, 5X, D15.8))                                  00067600
    3 FORMAT (/T6, 'IND VAR', T26, 'ESTIMATE', T46, 'OBSERVED', T66, 'RE00067700
     1SIDUAL'/)                                                         00067800
C--  FITPOL FITS A POLYNOMIAL OF DEGREE 3 OR LESS, AS NECESSARY, TO A   00067900
C    SET OF UP TO 6 OBSERVATIONS OF Y WITH INDEPENDENT VARIABLE XIN.    00068000
C--  DETERMINE NUMBER OF COLUMNS OR DEGREE OF POLYNOMIAL                00068100
      KOLS = NOBS                                                       00068200
      IF (KOLS.LT.2)   RETURN                                           00068300
      IF (KOLS.GT.4)   KOLS = 4                                         00068400
C--  LOAD X MATRIX                                                      00068500
      DO 20 I=1,NOBS                                                    00068600
      X(I,1) = 1.                                                       00068700
      DO 10 J=2,KOLS                                                    00068800
   10 X(I,J) = XIN(I)**(J-1)                                            00068900
   20 CONTINUE                                                          00069000
C--  LOAD XT MATRIX, YY VECTOR                                          00069100
      DO 40 I=1,NOBS                                                    00069200
      YY(I) = Y(I)                                                      00069300
      DO 30 J=1,KOLS                                                    00069400
   30 XT(J,I) = X(I,J)                                                  00069500
   40 CONTINUE                                                          00069600
C--  MULT XT TIMES X GIVING XTX                                         00069700
      CALL MMULT (XT, X, XTX, KOLS, NOBS, KOLS)                         00069800
```

```
C--  MULT XT TIMES YY GIVING XTY                                        00069900
      CALL MAVMPY(XT,YY, XTY, KOLS, NOBS)                               00070000
C--  INVERT XTX                                                         00070100
      CALL JNVRS (XTX, KOLS, 6)                                         00070200
C--  MULT XTX(INVERSE) TIMES XTY GIVING B                               00070300
      CALL MAVMPY (XTX, XTY, B, KOLS, KOLS)                             00070400
      WRITE (6,1) (B(I), I=1,KOLS)                                      00070500
      WRITE (6,3)                                                       00070600
C--  CALCULATE RESIDUALS                                                00070700
      DO 60 I=1,NOBS                                                    00070800
      YHAT = B(1)                                                       00070900
      DO 50 J=2,KOLS                                                    00071000
   50 YHAT = YHAT + B(J)*XIN(I)**(J-1)                                  00071100
      RESID = Y(I) - YHAT                                               00071200
      WRITE (6,2) XIN(I), YHAT, Y(I), RESID                             00071300
   60 CONTINUE                                                          00071400
      RETURN                                                            00071500
      END                                                               00071600
C--  JNVRS -- JNVRS -- JNVRS -- JNVRS -- JNVRS -- JNVRS -- J00071700
      SUBROUTINE JNVRS(A,N,KPRNT)                                       00071800
      IMPLICIT REAL*8 (A-H,O-Z)                                         00071900
      DIMENSION A(6,6)                                                  00072000
  301 FORMAT(' THE MATRIX TO BE INVERTED IS SINGULAR.'/'    THE PROGRAM 00072100
     1IS ABORTED AT THE INVERSION.')                                    00072200
C                                                                       00072300
C--  COMPACT-FORM GAUSS-JORDAN INVERSION METHOD --                      00072400
      DO 370 I=1,N                                                      00072500
      P = A(I,I)                                                        00072600
      IF(P) 320,310,320                                                 00072700
  310 WRITE(KPRNT,301)                                                  00072800
      STOP                                                              00072900
  320 A(I,I) = 1.                                                       00073000
      DO 330 J=1,N                                                      00073100
      A(I,J) = A(I,J)/P                                                 00073200
  330 CONTINUE                                                          00073300
      DO 360 J=1,N                                                      00073400
      IF (I-J) 340,360,340                                              00073500
  340 P = A(J,I)                                                        00073600
      A(J,I) = 0.                                                       00073700
      DO 350 K=1,N                                                      00073800
      A(J,K) = A(J,K) - P*A(I,K)                                        00073900
  350 CONTINUE                                                          00074000
  360 CONTINUE                                                          00074100
  370 CONTINUE                                                          00074200
C                                                                       00074300
      RETURN                                                            00074400
      END                                                               00074500
C--  MMULT -- MMULT -- MMULT -- MMULT -- MMULT -- MMULT -- M00074600
      SUBROUTINE MMULT (A, B, C, N1, N2, N3)                            00074700
      IMPLICIT REAL*8 (A-H,O-Z)                                         00074800
      DIMENSION A(6,6), B(6,6), C(6,6)                                  00074900
      DO 30 I=1,N1                                                      00075000
      DO 20 J=1,N3                                                      00075100
      C(I,J) = 0.                                                       00075200
      DO 10 K=1,N2                                                      00075300
   10 C(I,J) = C(I,J) + A(I,K)*B(K,J)                                   00075400
   20 CONTINUE                                                          00075500
   30 CONTINUE                                                          00075600
      RETURN                                                            00075700
      END                                                               00075800
```

```
C--  MAVMPY  --  MAVMPY  --  MAVMPY  --  MAVMPY  --  MAVMPY  --  MAVMPY 00075900
                                                                        00076000
      SUBROUTINE MAVMPY (A, B, C, N1, N2)                               00076100
      IMPLICIT REAL*8 (A-H,O-Z)                                         00076200
      DIMENSION A(6,6), B(6), C(6)                                      00076300
      DO 20 I=1,N1                                                      00076400
      C(I) = 0.                                                         00076500
      DO 10 J=1,N2                                                      00076600
   10 C(I) = C(I) + A(I,J)*B(J)                                         00076700
   20 CONTINUE                                                          00076800
      RETURN                                                            00076900
      END                                                               00077000
C--  CUMPLT  --  CUMPLT  --  CUMPLT  --  CUMPLT  --  CUMPLT  --  CUMPLT 00077100
      SUBROUTINE CUMPLT (A, B, AMIN, AMAX)                              00077200
C--   A  IS VECTOR OF ASCENDING VALUES; AMIN & AMAX ARE PLOT SCALE LIMITS00077300
C     B IS NUMBER OF OBSERVATIONS,                                      00077400
      DIMENSION A(100), HLABEL(11), VLABEL(9), PCTS(19)                 00077500
      INTEGER ARRAY(51,101)                                             00077600
      DATA IDASH, IHASH, MARK, IBLANK / '-', '|', '+', ' ' /            00077700
    1 FORMAT (10F8.3)                                                   00077800
    2 FORMAT ('1')                                                      00077900
    3 FORMAT (T8, F6.2, T16, 101A1)                                     00078000
    4 FORMAT (T13, 11(F6.2,4X))                                         00078100
    5 FORMAT (T16, 101A1)                                               00078200
    6 FORMAT (/T41, 'CUMULATIVE SAMPLE DISTRIBUTION OF IMPACT OBLIQUITIE00078300
     1S')                                                               00078400
    7 FORMAT (' PERCENTILES:'/T4, 'RANK', T17, '.05   .10   .15   .20   00078500
     1.25   .30   .35   .40   .45   .50   .55   .60   .65   .70   .75   00078600
     2.80   .85   .90   .95'/T4, 'DEVIATE (D)', T14, 19F6.1)            00078700
C                                                                       00078800
      ILINE(Y) = IFIX(50.5 - 48.*Y)                                     00078900
      IKOLUM(X,XMIN,XMAX) = IFIX(1.5 + 100.*X/(XMAX-XMIN))              00079000
C--   CREATE GRID UNDERLAY                                              00079100
      WRITE (6,2)                                                       00079200
      DO 20 I=1,51                                                      00079300
      DO 10 J=1,101                                                     00079400
   10 ARRAY(I,J) = IBLANK                                               00079500
   20 CONTINUE                                                          00079600
      DO 40 I=1,9                                                       00079700
      LINE = 6*I - 4                                                    00079800
      VLABEL(I) = 1.0 - (I-1)/8.                                        00079900
      DO 30 KOL = 1, 101                                                00080000
   30 ARRAY(LINE,KOL) = IDASH                                           00080100
   40 CONTINUE                                                          00080200
      DO 60 I=1,11                                                      00080300
      KOL = 10*I - 9                                                    00080400
      HLABEL(I) = AMIN + (.1*I-.1)*(AMAX-AMIN)                          00080500
      DO 50 LINE = 1,51                                                 00080600
   50 ARRAY(LINE,KOL) = IHASH                                           00080700
   60 CONTINUE                                                          00080800
C--   CREATE CUMULATIVE PLOT                                            00080900
      Y = 0.                                                            00081000
      LINE = ILINE(Y)                                                   00081100
      LINE = LIMITR(LINE,1,51)                                          00081200
      YINCR = 1./(B+1.)                                                 00081300
      ARRAY(50,1) = MARK                                                00081400
      N = B                                                             00081500
      DO 70 I=1,N                                                       00081600
      X = A(I)                                                          00081700
      KOL = IKOLUM(X,AMIN,AMAX)                                         00081800
      KOL = LIMITR(KOL,1,101)
```

```
      ARRAY(LINE,KOL) = MARK                                                00081900
      Y = Y + YINCR                                                         00082000
      LINE = ILINE(Y)                                                       00082100
      LINE = LIMITR(LINE,1,51)                                              00082200
      ARRAY(LINE,KOL) = MARK                                                00082300
   70 CONTINUE                                                              00082400
C--   PRINT CUMULATIVE PLOT                                                 00082500
      L = 1                                                                 00082600
      DO 250 LINE = 1,51                                                    00082700
      N = (LINE+ 4)/6*6 - (LINE+4)                                          00082800
      IF (N.EQ.0)   GO TO 230                                               00082900
      WRITE (6,5) (ARRAY(LINE,KOL), KOL=1,101)                              00083000
      GO TO 250                                                             00083100
  230 CONTINUE                                                              00083200
      WRITE (6,3) VLABEL(L), (ARRAY(LINE,KOL), KOL=1,101)                   00083300
      L = L+1                                                               00083400
  250 CONTINUE                                                              00083500
      WRITE(6,4) HLABEL                                                     00083600
      WRITE(6,6)                                                            00083700
C--   NOW INTERPOLATE 5TH-PERCENTILES                                       00083800
      K = 1                                                                 00083900
      N = 8                                                                 00084000
      DO 300 I=1,19                                                         00084100
      PCTILE = .05*I                                                        00084200
      DO 260 J=K,N                                                          00084300
      PJ = J*YINCR                                                          00084400
      IF (PJ.LE.PCTILE)   GO TO 260                                         00084500
      JJ = J                                                                00084600
      GO TO 270                                                             00084700
  260 CONTINUE                                                              00084800
      K=N                                                                   00084900
      PCTS(I) = AMAX + (PCTILE-1.)*(AMAX-A(N))/YINCR                        00085000
      GO TO 300                                                             00085100
  270 CONTINUE                                                              00085200
      K=JJ                                                                  00085300
      IF (K.EQ.1)   GO TO 280                                               00085400
      PCTS(I) = A(K) + (PCTILE-PJ)*(A(K)-A(K-1))/YINCR                      00085500
      GO TO 300                                                             00085600
  280 CONTINUE                                                              00085700
      PCTS(I) = PCTILE*(A(1)-AMIN)/YINCR                                    00085800
  300 CONTINUE                                                              00085900
      WRITE (6,7) PCTS                                                      00086000
      WRITE (7,1) PCTS                                                      00086100
      RETURN                                                                00086200
      END                                                                   00086300
C--   SNORM --  SNORM --  SNORM --  SNORM --  SNORM --  SNORM --  S00086400
      FUNCTION SNORM(Z)                                                     00086500
      IF (ABS (Z)-7.)1,1,2                                                  00086600
    1 SNORM=.5+SIGN (.5,Z)*ERRFX(ABS (Z)*.7071068)                          00086700
      RETURN                                                                00086800
    2 SNORM=.5+SIGN (.5,Z)                                                  00086900
      RETURN                                                                00087000
      END                                                                   00087100
C--   XNORM --  XNORM --  XNORM --  XNORM --  XNORM --  XNORM --  X00087200
      FUNCTION  XNORM(AP)                                                   00087300
C                                                                           00087400
C     THIS FUNCTION FINDS THE APPROPRIATE 'Z' VALUE UNDER THE 'NORMAL'      00087500
C     FUNCTION WHERE THE AREA FROM THE LEFT TO Z EQUALS AP.                 00087600
C     REF= 'HANDBOOK OF MATHEMATICAL FUNCTIONS', NATIONAL BUREAU OF STD.00087700
C                                                                           00087800
```

```
      IF (AP.LE.0.0) GO TO 1                                            00087900
      P=1.-AP                                                           00088000
      SIGN=1.                                                           00088100
      GO TO 2                                                           00088200
    1 P=AP                                                              00088300
      SIGN=-1.                                                          00088400
    2 T=  SQRT(ALOG(1./P/P))                                            00088500
      XNORM=T-(2.515517+T*(.802853+T*.010328))/(1.+T*(1.432788+T*       00088600
     1 (.189269+T*.001308)))                                            00088700
       XNORM=XNORM*SIGN                                                 00088800
      RETURN                                                            00088900
      END                                                               00069000
C--  ERRFX  --  ERRFX  --  ERRFX  --  ERRFX  --  ERRFX  --  ERRFX  --  E00089100
      FUNCTION ERRFX(X)                                                 00089200
C                                                                       00089300
C**** FROM THE HANDBOOK OF MATHEMATICAL FUNCTIONS - AMS 55              00089400
C**** NATIONAL BUREAU OF STANDARDS  NOV. 1970, PAGE 299                 00089500
C                                                                       00089600
      S=SIGN(1.0,X)                                                     00089700
      X=ABS(X)                                                          00089800
      IF (X.LT.1.0E-25) GO TO 1                                         00089900
      IF (X.GT.10.0) GO TO 2                                            00090000
      T=1./(1.+.3275911*X)                                              00090100
      SUM=1.06140543*T                                                  00090200
      SUM=(SUM-1.45315203)*T                                            00090300
      SUM=(SUM+1.42141374)*T                                            00090400
      SUM=(SUM-.284496736)*T                                            00090500
      SUM=(SUM+.254829592)*T                                            00090600
      ERRFX=S*(1.0-SUM*EXP(-X*X))                                       00090700
      RETURN                                                            00090800
    1 ERRFX=0.0                                                         00090900
      RETURN                                                            00091000
    2 ERRFX=S                                                           00091100
      RETURN                                                            00091200
      END                                                               00091300
```

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